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ROAD MAINTENANCE IN THE SEVERAL STATES

Methods Employed by State Highway Departments and Opinions Concerning the Importance of Maintenance, Contributed by Highway Officials for This Symposium—What Each State Has Done, and How, and the Results.

In the following articles twenty state highway commissioners, engineers or other officials have, at the request of Municipal Journal, described the methods employed most successfully by each in maintaining the roads of his state, and confirmed our opinion (so often stated) of the great importance of maintenance. In two or three cases the officials have sent us copies of papers or reports already prepared by them in which they had given this information; but the greater part of the matter following was most kindly prepared by the authors especially for this symposium.

MAINTENANCE IN NEW HAMPSHIRE*

Gravel Roads Kept in Excellent Condition by Continuous Maintenance at an Average Cost of \$240 Per Mile—Most Economical for Moderate Traffic.

By FREDERIC E. EVERETT, State Highway Commissioner.

After any road has been properly rolled and the surface has been made compact and smooth, it is desirable that it should always be maintained in that condition. It is a common rule that the finest roads are the result of good construction and a system of maintenance whereby each defect is corrected before it has time to cause serious damage. This rule is particularly applicable to a gravel

general forms of maintenance, which may be called continuous maintenance and periodical repairs.

It is not my purpose to analyze the merits or defects of these systems. Both have their advocates and critics and both their strong and logical argument. Personally I feel that both systems are correct. The type of road to which they are applied should regulate their selection. It would certainly be a waste of money to employ constant maintenance upon a high class pavement which we have every reason to expect will wear uniformly until such time as it needs resurfacing. On the other hand, it would be poor policy to let a gravel road go until it needed resurfacing. It is important that ruts and holes



A NEW HAMPSHIRE GRAVEL ROAD AFTER TWO SEASONS' USE.
Maintained entirely by patrolmen; no resurfacing or gang work at all.

road for the very obvious reason that if we are to build gravel roads and expect them to give their users the same satisfaction that the more expensive types would give, we must maintain as near a true section as is possible, free from ruts and holes.

The question next arises what kind of maintenance will accomplish this result. As we all know, there are two

should be filled as soon as they appear, for they will hold water which will soften the gravel bed and cause the road to wear rapidly.

The question now arises, what is the best method to adopt to accomplish this continuous maintenance? There could be only one answer to this so far as the gravel road is concerned, namely, the patrol system. A patrolman equipped with a one-horse hitch, shovel, rake and drag, etc., given a mile of road per diem, will find plenty

*From a paper before the American Road Builders' Association.

to do. A gravel road, to insure the maintenance of its cross section, should be dragged after every rain. Under the periodic system we could not do this, as it was impossible to provide so that your maintenance gang would be at the proper place at the proper time.

As we all know, a gravel road can be too wet or too dry to drag. In other words there is a certain time after a rain when the road is in the best possible condition to work and obtain results. The patrolman constantly on the road is going to know just when this time arrives. He is going to discover the weak places. He will see the small hole when it starts and before it has developed into a large one or a series of small ones. He can patch the roads in the early stages of disintegration without serious trouble or excessive cost.

Theoretically, if a patrolman gives his gravel road proper attention it should never need resurfacing. He will cart on and distribute enough new gravel to take the place of that which has been worn out under traffic. The patrolman fully illustrates that old adage "A stitch in time saves nine."

As an illustration of the favor in which we hold the patrolman's services, I will cite the increase that has been made in this branch of our organization. In the year 1911 there were two men employed as patrolmen on one

of our trunk lines for about two months. This was our first attempt with the patrol system. We have already appointed for the year 1916, 225 patrolmen. These men will be employed from April first, or sooner if the weather conditions permit, until December first. Their average pay will be \$3.25 per day. Now arises the question, how much money can be justifiably expended in the maintenance of a gravel road?

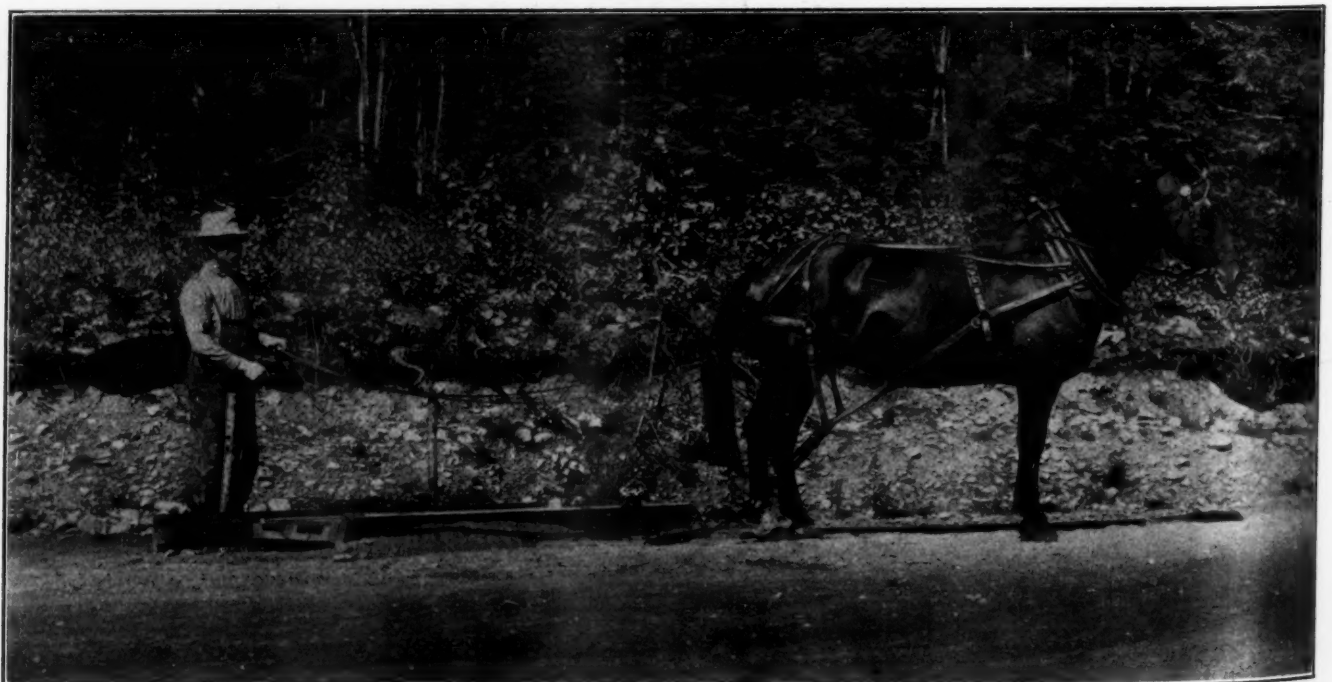
An article published in the "Engineering News" of December 9th, 1915, answers this question to perfection.

Assuming the cost of a modern country road pavement of the so-called "permanent" type at \$15,000 a mile (conservative) and supposing this to be paid for by twenty-year bonds at four and one-half per cent, the annual charges for interest on and redemption of the bonds amount to about \$1,150 per annum. It is safe to assume that even the most "permanent" type of country-road pavement will require repairs and maintenance of at least \$50 per mile per year, or in round figures we have a minimum of \$1,200 per mile per year as the cost of the improved road.

Assuming that a good gravel road may be built for \$4,000 per mile (which we have shown is more than the average cost of New Hampshire roads), the annual charges for interest on and redemption of bonds (if the roads are built by bond issue) at the end of twenty years would amount to about \$310. Therefore, it is theoretically economical to spend nearly \$900 per mile per year for the maintenance of gravel roads, if for that sum the roads



At the left is shown the patrolman and his outfit, prominent among the latter being his section number attached to a light steel rod which he plants by the side of the road when at work. In the photograph below a patrolman is seen dragging a gravel road. In this case he is dragging against the direction of travel, which is found to be very effective at times.



can be maintained in a condition equal to a pavement in the \$15,000-a-mile class.

Our claim is that, in New Hampshire, we are able to maintain this condition on four-fifths of our roads. This four-fifths carries an average traffic of about 300 to 600 vehicles, mostly motors, per day during the vacation season.

From the comparison just cited, we find that we can economically spend \$900 per mile per year for maintenance. Under the patrol system we do not find this expenditure necessary. Taking forty towns in New Hampshire whose state roads have been built of gravel and maintained by the patrol system, we find that in the year 1915 our average cost of maintenance per mile was \$240. This cost includes in some cases the surface application of a light asphalt or non-asphaltic oil. I will leave it to your judgment if this type of road is not the most economical for moderate traffic.

A doubt will probably exist in the minds of some when they take into consideration the amount of traffic that these roads carry and compare it with some of the elaborately worked out theories as to the wearing qualities of plain gravel roads, but we have the experience of several years of this type of maintenance and construction as a reputation.

In fact, any of these gravel or so-called combination roads which were originally built of necessity have worn so satisfactorily that today we are advocating this sort of construction as a principle. We believe that for four-fifths of our trunk line roads this type of construction is absolutely satisfactory for moderate traffic if properly maintained and by far the most economical road to build.

MAINTENANCE IN MAINE.

By PAUL D. SARGENT, M. Am. Soc. C. E., Chief Engineer, State Highway Commission.

STATE AID MAINTENANCE.

During 1915 we maintained 777 miles of state aid roads. These were distributed among substantially five hundred townships. This work was done through the local road forces, after our representative had looked the road over with the local officials in charge of ordinary road work, and laid out what should be done. The most of this mileage was gravel surfaced, less than twenty-five miles of it being macadam. The maintenance work consisted of ordinary repairs such as dragging the surface, raking rocks, cleaning ditches and culverts, trimming shoulders, mending guard rails and repairing culvert end walls. More or less new gravel surface was applied. The average cost of doing this work was \$130 per mile. The method is not satisfactory, as local officials are not responsive enough to the directions of the state highway commission.

STATE HIGHWAYS.

We had under maintenance during the season of 1915, 195.5 miles of state highway. Included in this mileage was about ten miles of portland cement concrete and fifteen miles of bituminous macadam; the balance being gravel surface.

The portland cement concrete was all built two or more years ago and was surface-treated immediately after construction with tar and sand. This concrete is all either ten or twelve feet wide, with macadam shoulders to make up a total width of twenty-one feet. Traffic over these sections of road is very heavy for about five months in the summer; running from three thousand to thirty-five hundred automobiles per day. This means pretty nearly a steady double stream of traffic. The principal expense

on this road is in maintaining the shoulders, particularly at the curves. A little patching of the tar surfacing had been done, but this was a very slight expense.

The bituminous macadam sections are 16 feet wide with gravel shoulders. These sections, which are two or three years old, received a very slight surface treatment of tar in the early spring; as little as one-sixth of a gallon being used and the tar being sprayed only where the surface showed signs of weakness.

Between the sections above mentioned are some sections of gravel-surfaced road which carry the traffic mentioned above. This gravel-surfaced road was surface-treated with Travia-B about May 20th, using about one-third of a gallon per square yard, and then covering with sand. The same gravel sections had been treated twice in the same way the season before, once about the first of June and the second treatment about the first of August, using for the two treatments about 0.6 of a gallon of tar per square yard. All of the above sections were patrolled through the entire season, between six and seven months, for the purpose of patching the surface and trimming shoulders, cleaning gutters, etc.

The average expense of maintaining all of the above sections, including surface treatment and patrol maintenance, was \$456 per mile.

The balance of the mileage of state highways, amounting to about one hundred seventy miles, were maintained as plain gravel-surfaced roads by patrolmen. Some of the mileage was not taken for maintenance until about July first, when it was completed by the contractors; although the most of it was under maintenance for the entire season. The average expense of maintaining these roads by patrol method was \$77 per mile. These were all new roads, completed the fall before or during the early part of 1915. It is probable that the traffic averaged four hundred and fifty automobiles per day and fifty horse-drawn vehicles of all kinds. It is estimated that a full season's maintenance by the patrol method will average to cost one hundred dollars per mile.

Where sections were surface-treated they were swept and prepared for the treatment by the patrolman with a horse broom. The tar was applied from a motor truck distributor by the parties from whom the material was purchased, at a cost of nine cents per gallon, applied. The tar was applied to one-half the road at a time and after a few hours it was covered with a very light coat of sand; the next day or day after, the other half of the road was treated. The state does not own any maintenance equipment.

Patrolmen furnish their own teams and equipment and are paid \$75 per month.

MAINTENANCE IN VERMONT.

By CHAS. W. GATES, State Highway Commissioner.

An act passed by the Vermont legislature in 1912 provided that the town selectmen may, with the approval of the state highway commission, designate a part or all of the selected highways to be maintained under the patrol system, and shall apportion a part of the highway tax for that purpose. Under this act, ten routes were established in 1913 covering 70.5 miles, and in 1914, 44 routes, covering 286.3 miles. The maintenance fund in 1914 amounted to about \$140,000.

In taking over roads to be maintained under the patrol system, towns are required to appropriate a sum per mile equal, at least, to the average amount per mile raised as a town road tax for all the roads in the town. When the roads to be taken over are of special importance to the towns, or are in bad condition, or get an excessive amount of local travel, more than an average amount is required from the towns, while the reverse is true where the roads

taken over are not especially important to the towns in which they are located.

Under this act the patrolmen are appointed by the state highway commissioner; are directly responsible to the state office, and can be removed at will, when work is unsatisfactory. Payments for the work are made direct from the state office by orders on the town funds until they are used up, and then by orders on the state maintenance fund for all subsequent expense.

The duties of patrolmen are practically the same as required of the town commissioner in their maintenance work, except that they are required to spend all of their time on their routes, or as much as is necessary to keep their roads in good condition at all times. They are required to drag their roads after rains, or when necessary to keep them well crowned so as to turn the water quickly off the surface. They are to keep the ruts and holes promptly filled, stones picked, ditches and culverts open, and free from obstructions.

The work required covers not only the pieces of road that have been improved with state money, but the intervening stretches as well, so that the whole route is kept from one end to the other in the best possible condition for travel, regardless of the materials of which the road is constructed.

Towns seem slow to take advantage of this law, but the traveling public are more than pleased with the results already obtained under it. Under a patrolman, some very common earth roads have been transformed into the smoothest riding summer roads to be found in the state, which emphasizes the importance of first taking good care of the roads we have, and then building more as fast as our funds will permit.

IN RHODE ISLAND

Effect of Insufficient Maintenance on Macadam Roads— Maintenance Methods on Bituminous Macadam— Renewing Seal Coats.

By IRVING W. PATTERSON, Engineer, State Board of Public Roads.

Before taking up the details of our maintenance work, a general description of our past work and an outline of the conditions affecting this branch of our work appear necessary.

This department was organized in 1902, and the first construction work undertaken was in 1903. All of the roads built previous to 1907 were of waterbound macadam construction, with the exception of a very short section of bituminous macadam laid as an experiment in 1906. From 1907 to the present time both bituminous macadam and waterbound macadam have been constructed. At present there are 325 miles of state road, 91 miles of which are of bituminous macadam construction and 234 miles of which are of waterbound macadam construction.

The average cost of state road construction in Rhode Island to date, including engineering and office expense, but not including maintenance cost, has been approximately \$7,500 per mile. With the average initial expenditure so low, it is apparent that all of our roads were not built to withstand successfully modern traffic.

A feature which has had a very serious effect upon our maintenance problem is the law limiting the width of state roads to 14 feet. This law was in force until 1912, when the limit of width was placed at 18 feet. The result of traffic of between two and three thousand motor vehicles daily upon a fourteen-foot waterbound macadam road is readily appreciated.

The character and amount of traffic, of course, has a

direct bearing upon maintenance. Rhode Island highways are subjected to a very severe traffic of pleasure motor vehicles in the summer months and to a severe commercial traffic during every month in the year. The large number of more or less famous shore resorts of this state accounts in large part for the heavy automobile traffic in the summer. A traffic census taken during the last summer showed a traffic of more than 4,000 vehicles upon Sundays and holidays over one of our main trunk lines between the hours of 6 A. M. and midnight. The large number of industrial establishments in Rhode Island is doubtless responsible in large part for the commercial traffic, which is very much in evidence during every month in the year. This commercial traffic is especially severe to our roads during the spring months when the frost is coming out of the ground.

The feature of our past work which perhaps has the most serious effect upon our present maintenance problem is the very erratic method of financing maintenance work in previous years. During the first three years that this department did work, there were no funds made available for maintenance work. It is generally admitted that a waterbound macadam road, which was the type built exclusively in those years, demands maintenance work practically as soon as they are constructed. The lack of maintenance funds for these years was, therefore, serious. In the years 1909, 1911, 1914 and 1915 no appropriations for maintenance were made. It is true that the net receipts secured from the licensing of motor vehicles were available, but the amounts so received in 1909 and 1911 were altogether inadequate. In 1914 and 1915 the accumulative effects of insufficient maintenance funds in previous years had brought about conditions which made the somewhat more generous funds available inadequate.

At the present time our waterbound macadam roads are in large part in poor condition, especially during the spring months. Our bituminous macadam roads, however, are upon the whole in very fair condition.

Maintenance work upon our waterbound macadam roads is carried out both by section gangs and by patrolmen. The more extensive repairs naturally are carried out by section gangs, and the lighter continuous repairs by patrolmen. At present our problem of maintaining waterbound macadam roads appears to us to be largely a problem of reconstruction. Much of our waterbound macadam is completely worn out, and where this condition exists the effect of ordinary maintenance methods is not gratifying.

The maintenance of our bituminous macadam roads consists of patching breaks in the surface and also occasional renewal of the seal-coat. We accomplish the patching of our bituminous macadam roads by section gangs equipped with light tandem rollers, heating kettles and the various small tools incidental to the handling of bituminous materials. We have not had the best of success with patrol maintenance of bituminous macadams, principally because of the necessary lack of suitable rolling equipment. Breaks of considerable extent in the metal surface of a bituminous macadam—such, for instance, as cuts by water companies and gas companies—cannot, we believe, be patched effectively without adequate rolling equipment. Our section gangs usually go over each section of bituminous macadam very carefully once each year, although in certain cases the roads are gone over once early in the spring and once in the fall. This system of patching bituminous macadams has proved in our experience to be very satisfactory.

Renewal of the seal-coats of bituminous macadam roads is done when breaks in the existing seal-coats become so frequent that patching is difficult and expensive. It

appears from our past experience that renewal of seal-coats is necessary at intervals of from five to eight years. The process of the renewal of the seal-coat as practiced in Rhode Island consists of cleaning the surface of the road, applying bitumen at the rate of from one-third to one-half gallon per square yard, and covering with clean stone screenings or screened gravel.

IN CONNECTICUT

Designing with a View to Minimum Maintenance Cost— Limit of Economic Maintenance—Maintenance Methods Depend on Local Conditions.

By CHARLES J. BENNETT, M. Am. Soc. C. E.*

The question of highway maintenance has been discussed so frequently of late that it would seem unnecessary to emphasize the importance of this topic. Nevertheless, annual charges for road maintenance are increasing so rapidly that we are practically forced to stop and consider what is to be done with the general highway improvement problem in order to keep our yearly charges at a minimum.

Someone has said that the maintenance of a road commences immediately upon its completion. This statement may be made much more emphatic by saying that the maintenance of a road commences immediately upon its design, since the cost of maintenance depends on the type of road designed.

The question of road maintenance divides itself into two distinct parts: first, the design of the road with the view to reduction in the cost of future maintenance; and second, the maintenance of those roads already constructed.

Any organization for the maintenance of highways should be formed with the view, first, to decide how much money should be spent in the maintenance of roads, followed by a definite plan as to what is to be done with certain roads in the system to be maintained in order to keep them in such shape that they will give the most efficient service possible with the appropriations made.

Almost every system of maintenance at present in vogue depends upon the judgment of the man at the head for the method of carrying on repair work; in other words, there is practically no information available which can be used as a basis for comparison as to costs or methods. The results of the system based on such judgment should be recorded, so that information will be available in the future.

Some general principles to be applied in allotting money for repair work might well be outlined.

It is evident that there is a point beyond which economic maintenance cannot be carried. That is to say, when a road gets in extremely poor condition (either through neglect or through excessive use), there is a point at which the road should be rebuilt. The greatest amount of money which may be used in the repair of this road can easily be decided if the cost of maintenance of the substitute road is known. Here again we are faced with a lack of information, which will, however, soon be secured if proper cost records of maintenance charges are kept.

It may also be said that it is possible to keep some roads in too excellent condition. Money may be wasted in surface repairs which are not necessary, due to the fact that the road may be used by slow moving traffic or be lightly used by all traffic.

It can easily be seen that any reduction in the cost of annual total maintenance over any given system of highways means the reduction in the fixed annual charges paid

by the taxpayers, and when the cost of maintenance is so excessive that replacements are necessary, replacements should be made in such a manner as to make the annual cost for maintenance of the road very low.

It would appear that road maintenance should be separated distinctly from road construction in the actual carrying out of the work. It is necessary, however, for the constructing engineer and the maintenance engineer to work together in order to get the best results for each problem. The work of the maintenance engineer is so vitally different from that of the construction man that there is the necessity for a separation, partly because the construction man generally has little knowledge of maintenance methods, but mainly because he is generally so much more interested in the construction work that the maintenance work is apt to suffer even if the lack of care is unconscious.

In the opinion of the writer, it is not possible to build up a standard system of maintenance for highway work. Each section of territory, perhaps each piece of work, must be treated locally. Differences in the location, climate, population, topography, class of traffic, character of local material, availability of labor, location of railroads—all enter into the planning of a competent maintenance organization, and these different things must be worked together in such a way as to solve the problem in the best manner for the local situation.

Generally speaking, the methods of maintenance as outlined above are local. The same is true of methods of maintenance as applied to different kinds of pavement. No actual standard can be formed in the treatment of any particular kind of pavement, since the variations of traffic and other local conditions have much to do with the condition of the pavement and the consequent repairs necessary thereto.

The same arguments apply to maintenance with reference to age of the pavement, since one pavement subject to light traffic will give ever so much better results for a longer time than the same pavement laid under adverse traffic or soil conditions.

To the mind of the writer, the subject of maintenance is one which has not yet received the careful attention that it merits and one which is worthy of the best attention of the engineer, since good results gained are of great benefit in reducing the annual cost to the man who pays the bills for public work.

While the above outlines some general principles which can be applied to the subject under discussion, it may be of interest to note the methods of administering maintenance work used in Connecticut.

In the first place, the funds available for maintenance work arises from two sources. First, an appropriation made by the State Legislature for maintenance and reconstruction; and second, the fees received from automobile licenses.

In apportioning these funds for any year, a budget is prepared showing the amounts of money which will be allowed for different sections of road, divided under the following heads:

First, ordinary maintenance, which includes the cleaning and shaping of shoulders, the cleaning of waterways, painting and repair of guard rails, necessary repairs to road surfaces, and patching, surface oiling and dust prevention, and the removal of leaves and debris.

Second, amount allotted for the reconstruction of certain specific roads in a poor state of repair.

Third, the charge for overhead, including office, administration and transportation—a total of about 7 per cent of the entire cost of maintenance.

Fourth, the amount allotted for equipment for the whole department, including the purchase of necessary supplies.

*State Highway Commissioner of Connecticut.

mentary machinery, as road oiling machinery, scrapers, trucks, stone crushers, small tools and barriers, etc.

The total of the money thus allotted is separated by towns and the amount of money expended on any particular road in a town is restricted. Monthly records are kept of the moneys thus expended and a general monthly comparison made.

For the purpose of administration the state is divided into ten repair districts under the supervision of a superintendent of repairs, reporting to the highway commissioner. The constructed roads in each district are under the control of a supervisor of repairs, who has his road repair gangs and patrolmen to carry out the actual repairs made necessary. The reconstruction mentioned is generally carried out by contract, and when such reconstruction is done, it is turned over to the construction department, although a record of the expenditures is kept by the repair department's bookkeepers.

The construction and maintenance are separate for the reasons outlined in the preliminary discussion.

The great difficulty that is found in reducing the annual cost of maintenance is that, while it is perfectly possible to demonstrate that a road should be resurfaced, while it is easy to illustrate this proof by figures, it is not always possible to secure the necessary money to carry out the work. Consequently in some instances larger sums are spent for the repair of roads than are economically consistent. Nevertheless, the annual charge for repairs is gradually being reduced due to the fact that the records of cost are kept and separated over different sections of the road about as outlined above. From these records it is easy to select the sections of road most in need of reconstruction. Use is made of graphic curves in comparing expenditures for different years and for different months in the same year.

IN NEW YORK STATE

Costs and Methods of Maintaining Plain and Bituminous Macadam, Bituminous Concrete, Cement Concrete and Brick Pavements—Adapting Bitumens to Use.

By FRED W. SARR, Second Deputy Comr. of Highways.

On April 1, 1915, there were improved and accepted 5,345 miles of state and county highways in New York. This mileage was increased as the season advanced and on December 31, 1915, there were 5,926 miles of improved and accepted highways, which have been maintained and repaired by the force under the Second Deputy State Highway Commissioner.

A summary of the mileage and the average expenditure for maintenance, repair and reconstruction per mile per year for each of the different types in use shows that:

- 193 miles of gravel roads cost \$955 per mile.
- 2,298 miles of waterbound macadam roads cost \$1,055 per mile.
- 2,387 miles of bituminous macadam, penetration method roads, cost \$510 per mile.
- 63 miles of bituminous macadam, mixing method roads, cost \$181 per mile.
- 295 miles of concrete bituminous roads cost \$1,050 per mile.
- 84 miles of first-class concrete roads cost \$129 per mile.
- 291 miles of block pavement roads cost \$190 per mile.
- 5,611 miles of all types cost \$750 per mile.

A review of the above summary would indicate that the various types could be grouped in three classes, namely, low, medium and high maintenance types, and when so grouped we have 438 miles of low maintenance type, including bituminous macadam, mixing method, first-class concrete and block pavement, upon which the average expenditure for maintenance was but \$177 per mile per

year; 2,387 miles of medium maintenance type, including bituminous macadam, penetration method, upon which the average expenditure was \$510 per mile per year; 2,786 miles of high maintenance type, including gravel, water-bound macadam and concrete bituminous, upon which the average expenditure was \$1,059 per mile per year.

If the low and medium maintenance types are grouped in one class, we have slightly over half the improved highways upon which the expenditure for maintenance is about \$440 per mile per year, and slightly under one-half the total mileage upon which the expenditure for maintenance and repairs was \$1,060 per mile per year.

It is contended that with the present system of maintenance the life of a pavement may in many cases be extended indefinitely. The method referred to is that of treating the surface of the pavement with a light application of asphaltic oil or refined tar, and a cover of fine crushed stone, sand or gravel. This treatment consists of spraying on the surface of the pavement about one-quarter of a gallon of oil or tar and covering the same with from ten to fifteen pounds of cover material per square yard of pavement. These materials are worked and kneaded into the existing pavement by the traffic, and most efficiently by rubber tire traffic, which results in filling up the small interstices between the larger fragments of the existing pavement and increasing the thickness of the pavement from an eighth to a quarter of an inch. This increase in thickness should more than offset the constant wearing away of the surface by the abrasion caused by the pounding of the iron-shod feet of the horses and iron-tire vehicles. The repetition of this treatment from year to year will gradually increase the thickness of the existing pavement. The ideal condition is where this treatment approximately maintains the pavement at its original thickness, as it has been found that where the treatment has been too heavy or too frequently applied and the oil and stone mat is built up to a greater thickness than one-half inch, it is liable to creep and become displaced by traffic, particularly in hot weather.

The experience of the department would indicate that a water-bound macadam pavement under the average condition of rubber-tire traffic, should be treated once each year for two years, then perhaps the treatment may be omitted the third year, and in subsequent years treatment is required two years out of three.

With the penetration type of bituminous macadam, a surface treatment is not generally required until the second or third year after improvement, and thereafter a treatment every second or third year. The advantage of this type of treatment is the ability to thereby incorporate a thin layer of new material with the existing pavement at a minimum cost and restore, at more or less frequent intervals, the part which has been worn away by traffic.

The necessity for this type of treatment is entirely chargeable to the fast-moving rubber-tire vehicles. Before the advent of the automobile an artificial binder of bituminous material was not necessary.

The horse-drawn iron-tire traffic tends by the impact of the horses' feet and the grinding of the iron tires under a heavy load to break up any particles of loose stone on the surface, crowding the smaller particles down into and uniting the same with pavement in wet weather and at all times maintaining a mat of fine particles, silted and bound together by moisture forming a protective carpet over the larger fragments.

The fast-moving rubber-tire traffic tends to remove all dust and fine particles from the surface and from the interstices between the larger fragments of the pavement until they become loosened and a hole starts which rapidly spreads until the entire top course is soon thrown to the side of the road.

The first observed effect of automobile traffic on the macadam roads in this state commencing about 1903, was the clean and bare appearance of the macadam, the large fragments of crushed stone being exposed to view, and it was necessary from time to time to sprinkle over the surface a light layer of sand or stone chips to relieve the rough condition of the surface which was disagreeable to traffic of light horse-drawn vehicles.

Where there was a considerable amount of horse-drawn iron-tire vehicles which would wear away the surface and provide an amount of fine material to offset that removed by the motor vehicle traffic, the surface would remain smooth under the combination of traffic, which would, however, rapidly wear away the top course decreasing the thickness of the pavement as much as one-half inch per year, necessitating resurfacing with new top course in from three to five years.

As the motor vehicle traffic increased, it became necessary to cover the surface of the macadam with a light layer of sand or fine crushed stone at frequent intervals during the summer season, and in 1907 and 1908 several sections of highway were given surface treatments of bituminous material and stone chips as an experiment.

In 1909, when the Maintenance Bureau of the State Highway Department was organized, bituminous surface treatments came into general use, and last season about 2,086 miles were thus treated.

Numerous grades of bituminous products have been tried out with varying results, the grade of the material representing the percentage and hardness of the bitumen residue contained in the product.

The most efficient material seems to be one that carries 65 to 70 per cent of bitumen or pitch and which can be applied in a spray under pressure at a temperature of from 80 to 100 degrees F. This grade of material is sufficiently liquid for several days after being applied that it may be worked and kneaded into the porous surface of the pavement by the rubber-tire traffic.

A heavier material that requires heating to a temperature higher than 130 degrees F. in order that it may be applied, cools after application and before receiving traffic, and assumes a consistency of rubber gum, and while it may be united with the stone chips by rolling, it cannot be as thoroughly worked into the body of the pavement, and simply lies on the surface as a mat which shifts around under traffic and is worked into waves and hollows. An example of the principle is the painting and varnishing of wood surfaces. A thin paint or varnish is applied and is worked into the pores of the wood by brushing and rubbing and a more desirable and permanent surface is obtained than by using a heavier or thicker varnish applied by pouring the same on the wood surface. The varnish being so heavy it is necessary to heat the material to make it sufficiently liquid to be poured over the surface. No one would expect such a finish to a hard wood floor to be very desirable or lasting. The floor could be opened to use very much quicker, but permanent results would not be expected. This simile is set forth as an explanation for the necessity of the disagreeable condition of the road surface for a few days after the bituminous treatment is applied, during which period the traffic is working and kneading the more or less liquid material into the existing pavement.

There is also the necessity for the use of the light material in the subsequent treatments in that the light carrier oils soften the hardened material of the former treatments and allow new material to unite and combine therewith.

The best results are also obtained where the least amount of cover material permissible is used. This can best be explained by comparing the bituminous material to Portland cement when used with sand in mortar. A

surplus of sand weakens the cementing qualities of the cement. The same results are obtained by using a surplus quantity of sand to cover the application sufficiently to eliminate the disagreeable condition of the freshly-treated pavement. Where the pavement is not open, requiring a filler for the interstices and where previous treatments have been given, better results will be obtained where no cover is used, but a freshly-treated surface with no cover is dangerous to fast-moving vehicles and such treatment is seldom resorted to in the country districts.

While the best results with surface treatments are obtained with a semi-liquid bituminous product and a minimum amount of cover, the disagreeable features of this treatment from a traffic standpoint have been given serious consideration and changes have been made in the specifications for surface treatments, which it is hoped will materially reduce the period during which the treated surface is objectionable from a traffic standpoint.

The light surface treatment with bituminous material and cover does not appear to be suited to pavements where horse-drawn iron-tire traffic largely predominates. The iron-tire traffic appears to grind the bituminous material with the mineral aggregate and keep the surface roughened and loosened, allowing the volatile oils to more readily evaporate. The bituminous material then loses its adhesive qualities and is ultimately ground to dust.

The bituminous mat tends to make the surface waterproof, and as the moisture in the macadam leaches away through the foundation and not being renewed from the surface the so-called waterbound macadam is no longer waterbound and is simply dust-bound and is ready to be loosened by traffic in any spot where the bituminous surface mat is worn through and it is necessary to either provide a heavy mat or constant patching of the areas where the mat has worn through. The tendency is therefore with the waterbound type to give a general treatment more often than should be necessary, which results in building up a heavy mat which finally creeps and displaces under traffic in hot weather, and it is then necessary to remove the entire mat and start over with the light surface treatments.

With the bituminous bound macadam this precaution is not as necessary. While the bituminous surface sheds off the surface water and the macadam dries out, the individual fragments are bound together with a bituminous material and are not susceptible to the loosening effect of traffic as they are in the dried out water bound type. The results being that a much thinner bituminous surface can be maintained without constant patching, which results in less frequent treatments being required, and the expense of maintenance of the surface by light bituminous treatments on bituminous bound macadam roads is not much over half of that for waterbound roads.

The bituminous macadam, however, being of a more plastic nature, is more easily displaced by swift-moving traffic, resulting in transverse waves developing in the body of the macadam, and is not as pleasing to ride over as the more rigid waterbound.

IN FLORIDA.

By ED. SCOTT, Chairman State Road Department.

The act creating this department gives it no authority to construct roads, but merely to act in an advisory capacity. We have no state laws regulating the maintenance of roads, but hope that such laws will be passed by the legislature next year. I heartily agree with the idea that maintenance is even more important than construction of new roads. In a majority of our counties maintenance is not given the consideration that should be devoted to it; consequently roads of all materials except brick (of which we now have several hundred miles) are rapidly deteriorating.

IN PENNSYLVANIA

Maintaining Earth, Gravel, Shale and Macadam—Asphaltic Surface Treatment—Asphaltic, Brick and Concrete Pavements—Bituminous Patching.

By W. R. D. HALL, Statistician, State Highway Dept.

The importance of highway maintenance is becoming more and more apparent each year and the problems confronting the highway engineer are becoming more and more difficult in proportion. Rapidly changing traffic conditions are responsible in the main for this. The power-driven vehicle, when it first appeared on the highway, wrote thereon, in a series of ruts and track marks, the end to the chapter of highway construction as understood at that time. No sooner had the engineer evolved a satisfactory wearing surface to meet this new demand than did the weight of the motor driven vehicles increase to such an extent that it is now plain to all who have studied the subject that pavements hitherto considered of a permanent type at the best are but makeshifts.

Necessarily, all that has been done cannot be abandoned. For economic reasons alone it is important that as much of the existing "good" road as possible be preserved until such time as the secret of the indestructible highway has been discovered. This is where the insistent problem of maintenance appears. Just how to solve it best is in itself a perplexity.

The Pennsylvania State Highway Department, hampered from the very outset by lack of funds sufficient to construct any appreciable percentage of the 10,200-mile network of roads thrust upon it through legislative enactment as a state highway system, has addressed itself particularly and industriously to the subject of maintenance. It has been decided that it is far better to attempt to maintain, in as good condition as possible, those travelable roads which it has under its care, than to endeavor to construct or reconstruct a relatively small mileage of the entire system.

By far the greatest mileage in Pennsylvania is of earth roads. Maintenance for this type of highway, relatively, is a simple operation. The use of the road machine and the humble, but nevertheless the highly efficient, road drag constitute the first steps taken after the primary precautions of opening ditches, providing satisfactory drains, and the elimination of water-breaks, or "thank-you-mams," have been taken. While it is universally recognized that water is the foe of all good roads, in no instance is this more noticeable than in the case of earth roads. Therefore the earth road is in the best condition possible to withstand those seasons of the year hardest on it, when free from the menace of water and so shaped and crowned as to permit the rain-fall to drain easily and naturally to ditches.

During the season of 1915, the Maintenance Division of the Pennsylvania State Highway Department thus treated 5,824.45 miles of earth roads on the state highway system. This work, of course, will have to be repeated during the present season and, in fact, during every season until these earth roads are replaced by others of a more permanent type.

In the next grade above the earth road comes the gravel, flint, and shale road classification, where the road material furnishes an ideal combination for the spring, summer and autumn months, but goes to pieces rapidly under the rigorous attacks of winter. The Maintenance Division during 1915 maintained and repaired 557.75 miles of roads of this type, flint and shale predominating. The shale road responded readily to a surface treatment of asphaltic oil, which made a perfect road surface until such time as the frost penetrated the subgrade and, in breaking up,

caused the familiar billowy waves to appear in the road surface. This was true also to the same extent with the flint roads thus treated. With this type of highway, as with the earth road, no success can be gained unless drainage conditions are as nearly perfect as it is possible to have them.

In Pennsylvania there is a type of road encountered which has caused considerable trouble in maintenance. There is a large number of abandoned toll roads, or turnpikes. Following the custom, these roads for years were taken care of by their owners in the simplest and easiest manner. When a rut or depression was found in the road, it was filled with broken stone which was left for the traffic to iron into compactness. If it happened to be a soft spot in the road, more stone was applied. If, through any accident of nature, the foundation was solid, less stone was necessary. It is no uncommon thing to see, in a five-mile stretch of abandoned turnpike, stone surfaces varying from two or three inches to two or three feet in depth. Few, if any, of these old turnpikes were built on a telford base and until the advent of the motor driven vehicle few, if any, were macadamized, excepting in so far as vehicular traffic would pulverize the surface stone and the fall rains would effect a temporary cementation. Wherever a road of this type is encountered, the Maintenance Division has endeavored to resurface it with a water-bound macadam, which, subsequently, is given a surface treatment. It is recognized that this form of maintenance is temporary and no more of it has been done than has been absolutely necessary.

Another class of highway in Pennsylvania which has come under the jurisdiction of the State Highway Department has been the county or township-built highway where, in most cases, an intelligent effort has been made to provide an ideal foundation, or base course, as of telford, which has been covered with a water-bound macadam surface. Many of these roads have been resurfaced by the state department and given surface treatment of asphaltic oils. During the season of 1915 the Maintenance Division resurfaced roads of these types aggregating 396.99 miles.

The higher types of highway of a semi-permanent character, on which the maintenance charges, necessarily, are not so high, but which require vigilance to prevent deterioration, include the asphaltic macadam, the asphaltic concrete, the brick pavement, and the concrete and reinforced concrete roads. For the most part these highways in Pennsylvania are those built by the State Highway Department under contract, and those built by state aid. The maintenance of these highways has been provided for by the state department through a system of caretakers, or patrolmen, each one of whom has charge of stretches of from three to six miles of road. These patrolmen are supplied with equipment and materials and are instructed to repair minor breaks, abrasions, etc., as soon as they are discovered. In pavements of the bituminous type, patching is done with bituminous material and stone chips, the hole, rut, or abrasion first being carefully cleaned and the edges softened so that the patching material will bond properly with the surface of the highway. These patrolmen are employed at all seasons of the year and are in a position to give immediate first aid to the injured highway. Blocked ditches, stopped up drains, obstructions to vehicular traffic, defective guard rails, washouts, and slips and slides come to their attention and are remedied by them. Supervision of these caretakers is provided for and careful data are kept as to their work and the cost incurred. During the season of 1915, the Maintenance Division improved 1880.48 miles of these grades of highways.

Where the bituminous wearing surface of a highway

deteriorates to such an extent as to render it necessary, resurfacing is applied.

The Maintenance Division has worked out a simple but comprehensive system of reports whereon are kept records of cost data, maintenance charges, and other informative statistics.

MARYLAND MAINTENANCE METHODS.

Maintenance methods as conducted in Maryland come under two heads: continuous maintenance, which includes the patrol system, the gang system or a combination of the two; and oiling, which is done once or twice a year. Where the patrol system is used, the patrolman has charge of 4 to 8 miles of road, the length of section depending on the amount and intensity of traffic. He is supplied with a mattock, pick, shovel, wheelbarrow, concrete rammer, scythe, tar pot, red flag and cap. He is also furnished with a number to wear on his left arm as a means of identification.

A form of printed instructions as to his duties are furnished the patrolman. Among other requirements, he must walk over the entire length of his section at least twice a week and after each heavy rain or snow storm. He reports the passage of sharp-cleated traction engines over the road and stops any digging or placing of obstructions in the road without special permit.

Patrolmen are expected to keep all ditches, culverts, and under drain inlets and outlets open at all times. The shoulders are to be kept to the proper grade and any wash-cuts or large wheel-ruts are to be filled immediately, keeping the shoulder in good line. All grass is to be kept close cut on the shoulder and slopes. They are also required to pay particular attention to the surfacing on their roads and patch any places which are bare or loose. These patches are to be made as instructed by the resident engineer, whom the patrolman shall notify when patching is required.

To enable the patrolman to make bituminous patches he is supplied with stone chips and bituminous patching material at convenient points, so that with the aid of a wheelbarrow he is in a position to transport material, without any unnecessary delay, from the stock piles to any abrasion or hole that occurs in the surfacing, and in this way no time is lost in making the necessary repairs.

It is difficult to teach patrolmen just how to make patches to the surface where the holes are deeper than 1 or 2 inches, for they either apply too much bituminous material, which causes a pushing about and a "hump," or not a sufficient amount, causing immediate disintegration.

The patrolman is instructed to make patches as follows:

First, sweep the hole thoroughly clean, free from all dirt and dust; paint the cavity with bituminous material; tamp the stone in well with a tamper, then spread bituminous material over the stone, and apply stone chips from $\frac{1}{2}$ to $\frac{3}{4}$ inch in size, just bringing the surface of the patch up to the same elevation as the adjoining surface of the road. It has been found that quite a number of patrolmen can make these patches without a great deal of trouble and get the proper amount of oil in so that the patch will be permanent and not push about, but there are many instances where they either get too much bituminous material in and it pushes about and makes a hump, or do not put sufficient in, and the consequence is "ravelling." To aid them, therefore, in getting just the proper amount of bituminous material in the patch, the patrolman should be supplied with a small wire basket holding about a peck of stone. This basket has handles and it is only necessary for him to dip the basket

containing the stone into the bituminous material, raise it and allow it to drain. All that is then necessary is to dump the stone from the basket into the hole, tamp and cover with stone chips.

The gang system has been used on a number of heavy travelled roads, and comprises a foreman and 7 to 10 men, who take care of from 40 to 60 miles of road. The gang is supplied with the necessary small tools, a roller, and a camping outfit. While the gang system was slightly more economical the most satisfactory results were not secured, owing to the fact that the intervals between which the gang passes over the road are so long that when there is a disintegration in the surface it cannot be fixed immediately, and the consequence is that by the time the gang visits the spot it is a large hole. Then too, the men working in a gang are less efficient when separated than the patrolman.

The combination gang and patrol system is most satisfactory on sections of road where there are many cuts and fills and where the banks very often slide. In such cases, it is the gang's duty to go over the roads early in the spring, remove all slides, shape all shoulders, open all ditches and culverts, make all the necessary repairs, and put the road in first-class condition. When this is done, the roads are then turned over to the patrolmen, and they can take care of a larger number of miles than they could if required to do all the work in the spring by themselves. The combination patrol and gang system is more economical on certain types of road than the gang or patrol systems alone. It is, however, impossible to set any hard and fast rule as to whether the gang should be used on any section of road or the patrolmen. In any event, it is necessary before deciding upon any method of maintenance to study carefully the topography of the country, the character of the soil, the amount and kind of traffic, and type of surfacing.

With a well organized system of maintenance and with carefully selected patrolmen, it is possible to maintain roads in the highest state of efficiency, and at the end of a period of 10 or 15 years the roads will be in better condition than they were when first taken over from the contractor. To secure such results, however, it is necessary to build up the road and increase its thickness in accordance with the amount that is worn away by traffic. To know exactly how much the roads wear away each year, a number of cross-sections are taken in the following manner:

Two permanent benches are established on each side of the road at the same elevation and a string is then stretched across which makes it possible to get an accurate measurement of the road surfacing. These readings are taken every two feet apart, transversely. This is done every six months and after each oiling, and a record is kept of exactly how much is worn off the surface of the road. Having this knowledge at hand, it is the object to place on the road, each year, an amount greater than that worn off, and to accomplish this end the size of the screenings placed each year during oiling has been increased from $\frac{1}{2}$ to $1\frac{1}{2}$ inches. The quantity of oil has been reduced from $\frac{3}{4}$ gallon to $\frac{1}{3}$ and $\frac{1}{4}$ gallon, and the quantity of stone chips has been gradually increased from 20 tons per mile to 125 tons per mile, depending upon the amount and intensity of traffic.

For oiling roads, bids are asked for delivering stone chips per ton mile on various roads and a contract is let to the lowest bidder. The chips are piled at convenient points, about 15 to 20 tons per pile, and a day or two before the oiling truck reaches the work, they are redistributed into smaller and more convenient piles, so that they can be more readily spread over the oil work. As soon as the oil truck passes over the road, large chips are spread on

and immediately rolled in, then a layer of small chips is applied and also rolled in.

Each year the quantity of oil has been reduced and the quantity of stone chips increased until the percentage of the cost of oiling and stone chips is 40 per cent for the stone chips.

The larger stone are used for the purpose of preventing the oil from forming a mat on top of the road which pushes about and makes a rough and uneven surface. Owing to the large amount and size of stone, the coat locks closely together, and there is little trouble due to pushing and shoving about. About 60 to 75 tons of large stone and 20 to 30 tons of small stone per mile are used.

The roads are thoroughly swept by a power sweeper and by hand before the oil is applied under pressure by an automobile truck distributor.

After the specifications are drawn up, bids are asked, calling for a certain number of pounds of oil to be applied per square yard of surface. With the bid the manufacturer of the oil must submit a sample as well as a guarantee that he will furnish oil, or tars, of a quality as good as the sample submitted. He must furnish also an analysis of the same. The contract specifies that if the oil or tar falls below a certain percentage specified, the commission will not pay for it but will pay for the application. In order to get a fair sample, the oil or tar, as the case may be, is agitated and samples taken from the car by means of an oil thief.

It has been found that if the roads are thoroughly swept, the oil applied, and good clean stone chips spread, it is not necessary to apply oil more than once every two years on medium travelled roads, though heavy travelled roads should be oiled every year.

The study regarding the amount of wear on the roads has not been carried far enough to know just the amount worn off of each during each year, but as soon as this information is ascertained, an effort will be made to apply slightly more hard material at each oiling until the base of the road has increased from 8 to 10 inches in thickness. It is believed that this amount of thickness is necessary to support the large loads being hauled over the roads in motor trucks and other heavy vehicles.

IN VIRGINIA.

By G. P. COLEMAN, State Highway Commissioner.

The State Highway Commission of Virginia was organized in 1906 and since that time approximately four thousand miles of road have been improved under the supervision of the department. In the first annual report, published in 1907, the department recommended to the Governor and the Legislature that some provision should be made for the maintenance of the roads which were being constructed. This recommendation has been repeated from year to year and has been emphasized through the state press. No action, however, was taken on this important matter until the 1st of March of this year, when the Legislature which has just adjourned passed what is known as the "Automobile Maintenance Bill," placing the licenses which are derived from this source in a maintenance fund to be used by the highway department in the maintenance of the roads which are being constructed with state aid. This law requires that the counties shall meet the fund with a like amount. This will give us for the coming year approximately \$450,000, which will be inadequate, but we hope that succeeding legislatures will increase the appropriation from other sources.

An engineer of maintenance has been appointed, but we have as yet worked out no definite plan to be followed. We expect to use, where possible, the organizations which have already been formed in counties, in gangs for

heavier work, such as opening ditches and distributing repair material, etc., and to establish wherever possible the patrol system, the patrolman being expected to repair small breaks in the surface, open cross drains and keep the weeds cut from the shoulders, etc.

In this connection we also propose to parole the higher grade of our prisoners and use them in connection with our maintenance department as patrolmen, these patrolmen to be paid from the automobile maintenance fund. This we believe will have a two-fold benefit; first, in giving honorable employment to prisoners and using the same as a reward for good behavior; second, in giving the state and the counties of the state the services of men trained in road construction and the maintenance of the roads which they have constructed. This will be a great advance in the convict honor road system.

IN WEST VIRGINIA

Make Repairs with Same Material as Used in Construction—Repairing Earth, Macadam and Bituminous Macadam.

By A. D. WILLIAMS, Chief Engineer State Road Bureau.

The subject of road maintenance is one of the most vital questions before the American people today, because the good roads movement has received such an impetus as to make the raising of funds for road construction a simple and easy matter as compared with the acquiring of funds, talent and diligence necessary for proper repair. No community should provide for road construction without making adequate maintenance provisions, because to vote a public debt for highway improvement and then neglect to maintain the road is almost a crime. There is no place where the time worn adage "a stitch in time" means more than in road maintenance. Road maintenance should be begun the day construction ends. The heaviest maintenance period on a great many roads is within the first five years of the road life.

A well graded earth road can be maintained by dragging and keeping the ruts out, and the holes filled with the same class of material with which it is constructed. A great many road supervisors have conceived the idea that to fill a mud hole it is necessary to go a long distance and at a great expense, get stone which, when placed in the mud hole, lays a foundation for two holes. A careful study of the various highways or types of pavement will reveal that the best maintenance is by making repairs with the class of material out of which the road was constructed. The writer recently visited a community where a supervisor was hauling stone at a cost of approximately \$2 per cu. yd., when good earth to make the same fill for which he was using the stone could be had in place at not to exceed 20 cents per cu. yd. This was called to the gentleman's attention in the forenoon, and when returning in the afternoon, I found the supervisor about two miles further up the road filling another mud hole in the road, and he remarked that he had accomplished more by following the simple suggestions in that half day than he had expected to accomplish in two weeks. The way to improve a mud hole in a mud road is to first drain and clean out the muck and mud, and then refill the hole with fresh material tamped firmly in place.

To repair a water bound macadam road, tar or bitumen should never be used on the newly placed stone, but the hole should be cleaned out and filled with fresh stone screenings which should then be sprinkled with water and tamped until firm. An example of this can be seen on the macadam road leading from Bluefield, West Virginia to

Princeton, in which the repair was made by using tar on the newly placed stone. In each case there is a hole, a bump, and another hole, which is worse than if no repairs had been made.

To repair a bituminous macadam road, the hole in the road should be well cleaned and a sufficient quantity of fresh stone to even up the depression should be placed in a wire basket which can be dipped into a melting pot of hot tar or bitumen, then raised and let drain so that only sufficient tar will remain on the stone to make the necessary binder. This then can be tamped in place, after which screenings can be spread and the road is ready for use. Where little depressions show on the surface, the defect should be cleaned and painted with tar or bitumen and sufficient screenings placed thereon to even up the depressions.

A concrete road should be repaired by cleaning out the cracks and crevices and keeping them filled with tar. Care should be taken not to spread more tar than will fill and rightly protect the joints.

Cracks or holes in asphalt or asphaltic concrete should be repaired by the use of proper heating kettles.

In brick roads all broken and chipped brick should be removed where possible and good brick replaced.

In conclusion let me repeat that, with most classes of road, the repair should be made of the material of which the road is constructed, and as soon as possible after the defect is discovered. No road should be neglected after a defect appears. If these simple principles are followed, much of the people's funds can be saved. Every road official should see the road, or have reports upon it, as often as possible.

IN MINNESOTA

Be Politic but Avoid Politics—Definite Personal Responsibility for Results—Patrol Work—Repair Crews—Dragging.

By JOHN H. MULLEN, Deputy State Engineer.

The problem of road maintenance is far from simple in some states, for the reason that the roads which the several governing boards have to care for have been only partially constructed, and such portions as have been constructed were improved under authority of different units of government; and it is claimed by some that the town or county, as the case might be, should only maintain roads which are substantially built under their supervision and expenditures. Therefore in organizing for effective maintenance, the laws or regulations must be carefully drawn so that the state is not hampered by legal opinions that the funds belonging to one unit can only be expended for maintenance of the portions of roads constructed by that unit of government.

A reasonable construction of the term "maintenance" as applied to roads and one which we have adopted is this: For the county or township board to keep in the best possible condition all portions of all roads under their supervision, whether such roads have been improved by that board or whether improved at all. A maintenance fund should be provided sufficient to, and should be used to, maintain comfortable and economical travel over the whole highway, rather than to keep a highly improved section of the road continuously in the condition in which it was left at completion of construction. The latter is very difficult of accomplishment at any rate, excepting on very expensive surfaces, and does not prove popular unless the whole length of road is improved; but we find that in nearly all communities the well improved sections of road are not continuous and are separated by portions of ordinary or less than ordinary dirt roads.

The highway engineer or official must face one fact squarely, and that is that although road affairs should be kept out of partisan politics, road administration must be handled politically; in other words, while endeavoring to properly construct our roads, only a small portion of which can be done each year and which naturally affects only a small percentage of people, we must make it possible for the greater number of road users to "get somewhere" with convenience, in order to have their continued support in the better roads movement; and ten miles of good road, with one or two bad miles intervening, will leave with the average citizen an impression of poor management and disgust with road conditions.

Each unit of government having charge of roads should make an examination of the roads in its care each year and estimate the amount of money necessary to provide for an adequate system of maintenance, and set that money aside to be used for that purpose and no other. In general there are two classes of roads, state roads, under state and county supervision, and township roads, under township supervision. State roads should, and usually do, cover the main lines of travel, and the proper upkeep of these roads is the most important duty of the highway engineer or superintendent. In the average county about 40 per cent of the state road mileage is improved in scattered locations, with the remainder in various degrees of passability; therefore, a system must be inaugurated which will make the best of the different conditions encountered. In this respect one fundamental point must be kept in mind, and that is that, whatever system is devised, it must have as a keystone a definite personal responsibility. Let the county board or county road committee, in conjunction with the engineer or road commissioner, determine upon the system for maintenance and provide the funds therefor, but when that is done *place the work in the hands of one man*, the engineer, give him authority and place upon him the responsibility for the condition of his road, and almost any system adopted will be a success. Usually the engineer is considered responsible by the tax payers anyway, but no man should be shouldered with responsibility unless given authority and funds with which to discharge his office.

There are three systems of organization which have been found effective and efficient for different general conditions.

First is the patrol system, which is applicable to the few counties which have the greater portion of their mileage improved. This system is handled as the locality requires. On hard surfaced roads the sections can be laid out in four- to six-mile divisions, with a man working constantly on each section from the beginning of the spring break up until freeze up in the fall. His equipment consists of a wheelbarrow and hand tools, but his work must be augmented by the use of teams and a grader in the spring to reshape the roadbed and to haul and deposit repair material at convenient points along the line. His instructions, in a nut shell, are to keep lines of drainage open and prevent the forming of ruts and chuck holes. One important requirement is that he go over his section on foot during every heavy rain and mark each place where water stands on the surface. It is only in this way that incipient bad spots may be detected before they become objectionable. The length of a patrol section depends upon the volume of traffic, as will be noted by the efficient service given under this system on twenty-five-mile sections in Northern Minnesota on roads partially surfaced where travel is very light. Several counties which have various types of surfacing on the same road, with earth roads predominating, have had good success by the establishment of patrol sections from ten to twenty miles in length, on each of which a man and team is em-

ployed continuously with one helper and who is given authority to hire local residents when necessary to do additional dragging. The patrol man is required to furnish the team and wagon with dump boards, and the county provides a light grader, road planer, slusher, plow and shovels. This is probably the most efficient system for the average county and generally results in good-natured rivalry between the patrolmen, with a feeling of responsibility for and pride in their work. All patrolmen must receive their instructions from and report direct to the engineer in charge of work in the county, who has authority to remove unsatisfactory men. The patrolmen are employed by the County Board on recommendation of the engineer, excepting in the case of a removal or vacancy, when the engineer employs a temporary patrol until such time as the board meets. We have found that by furnishing each patrolman with a badge on his cap, greater interest is shown by all concerned.

The second method of maintenance is by repair crews of two to four teams with a few extra men and regular light roadbuilding equipment. This system is not very satisfactory on account of the large territory which the outfit must necessarily cover, which means that the foreman cannot very well be held responsible for the condition of the roads on which he is working. The only place where this system is really applicable is in localities where the roads have gone entirely to the bad, and have to be completely reshaped in order that dragging or other ordinary maintenance will be effective; and even under such circumstances the organization of team patrol sections, with some extra help for a short time, is found to be more efficient.

Third is the dragging system. This method is established in counties having almost entirely earth road mileage. The county engineer or superintendent is in general charge of work under this system and enters into contract for the county with residents along the road, to drag certain definite sections after each rain and whenever ordered by him. These sections may vary from one to three miles for team haul and up to ten miles or more with a tractor. In contracting this work, a price per mile for dragging and per hour for extra work, such as clearing ditches, etc., is agreed upon, and it is stipulated that the price of the first few draggings be retained until the end of the season, and any neglect to drag when necessary be compensated for by deduction from the retained percentage of an amount which would otherwise have been paid to the contractor for the work which should have been done. It is manifestly impossible to closely check this work, but by having a system of reporting by post card immediately after each dragging and using these reports as a basis for making monthly payments, it is found that few errors occur, and the engineer is generally given considerable voluntary assistance and information by those using the road. The telephone is a valuable adjunct to this work and it is found that after the work is well under way the engineer can select the best man in each locality and entrust him with the authority to call out the drags by phone when necessary and he can also save considerable telephone charges by having such men spotted to distribute hurry-up orders to the draggers.

The details of maintenance work are so various and so dependent upon local conditions that it is difficult to lay down a set of requirements which will cover the situation in a whole state. In the first place, the road must be made ready for maintenance, and in fact this is considered as a part of the maintenance work. The use of a light grader in opening up drainage and bringing back the crown of a road is almost necessary each spring, and on most roads several times during the season. The kind of drag to use has been quite a study, and although many of the so-

called log type are in use, it has been demonstrated that the light graders and road planers are much better, for the reason that the ordinary drag does not level the road longitudinally, but on the contrary tends to gouge out depressions; while an implement similar to the Minnesota road planer will level the road longitudinally as well as transversely, and will reduce the waviness found so objectionable on many highways. There is a question as to whether dragging shall be done by tractor or teams. At Owatonna, Minnesota, drags drawn by a team cost on the average 52 cents per mile for the season, with team and man at \$4.00 per day. A light tractor with two-way drag costs an average of 29 cents per mile for the same service, taking into account all charges, including depreciation of 20 per cent on outfit for the year. The engine was used to haul gravel when not dragging, which brought the cost of plant down considerably in figuring the dragging. This comparison would indicate that a maintenance section equipped with a light tractor might be the best organization.

The amount of dragging or maintenance work depends upon the season and soil condition, and in our experience runs from about six to 35 draggings per year, although some of the sand roads are dragged very seldom—only enough to bring back to the wagon tracks the straw which is placed as a part of the maintenance work.

As an indication of the cost of maintenance on main travelled roads, the past year's experience in Minnesota gives an average of \$46.13 per mile for 9,900 miles, with the low average in a sandy county of \$23.06 per mile, and a high average of \$227.64 per mile in a county containing one of the large cities. In the average county, dragging costs about half and general repairs the balance.

In conclusion I wish to emphasize the necessity for organizing the maintenance work systematically; get the men to take pride in their work; hold them responsible; and get them together at least once a year for instructions and exchange of ideas.

ILLINOIS ROAD MAINTENANCE

Selecting Type of Road to Secure Uniform Cost Per Unit of Service—To Keep Accurate Records of Maintenance Costs.

By WILLIAM W. MARR, Chief State Highway Engineer.

I quite agree with the idea that maintenance is one of the most important considerations before road officials and one which is sometimes neglected. In Illinois, however, it takes on an added significance because of the construction of our new road law. The state, under the Tice laws, is charged with the duty of maintaining all of the roads of the state aid system, comprising 16,000 miles of designated state aid roads connecting all cities and villages of the state, or about twenty per cent of the total road mileage outside incorporated towns.

Under the law, the state pays for half the cost of construction and for all of the cost of maintenance for concrete and brick roads; the state and county each pay one-half of the cost of maintenance of gravel and macadam roads; and the county pays all of the cost of maintenance of earth roads. The jurisdiction is in the state. Payments are made from the automobile fund and such other appropriations as may from time to time be made by the legislature.

The available funds are allotted yearly to the counties in accordance with the amount of road and bridge tax levied by townships. This method has in the past resulted in the designation for improvement of only short stretches of road in various parts of the county, all on the state aid system, but in few instances in accordance

with any preconceived plan for connecting first the main trading centers, as was intended by the legislature. The reason is that county boards, which have the power to designate the particular section of road to be improved, have used this power in many cases unwisely, with the result that high types of road have been designated for use in out-of-the-way places.

An amendment to the law made in July 1915 gave the counties power to issue bonds for the immediate construction of all state aid roads in the county and to anticipate half the cost of construction to be paid by the state from allotments made yearly. This has resulted in an unprecedented movement in road matters throughout the state. Thirty-six counties are now contemplating bond issues, and the State Highway Department has prepared plans for twenty-five of these counties. Our aim has been to design the county systems in such manner as to approximate as nearly as possible a unit cost of service which should be consistent throughout the system; that is to say, proportion the type of road to the probable traffic, so that the first cost, plus interest cost, plus maintenance cost, divided by the amount of traffic, will result in a uniform rate of cost of service.

This has tended to bring home the great importance of maintenance cost in the economical design of the system.

Maintenance cost depends principally on the excellence of construction; on the extent of the work; on the use of modern equipment; on the intelligence of supervision; and on the skill of the labor employed; and on constant attention.

With these ideas in mind we have established a bureau of maintenance in this department, under the direction of an able engineer who has been connected with the work of the department for eight years, and who has just returned from an extended trip through the eastern states gathering information as to the successful methods in operation and their application to our own needs. It is contemplated that this work will be carried on under his direction through the division engineer in charge of a territorial district of the state and through various superintendents of highways and organized forces in smaller units.

Under our law, the state being obligated to maintain all the roads of the system, the problem of life of pavements disappears; and regardless of whether or not the proper type of improvement has been selected for any particular road, the service will be maintained to a constant standard of excellence at all times. This may necessitate frequent additions of material, or resurfacing from time to time with a more durable wearing surface, depending on the cost of service as determined by our records of maintenance cost.

It is planned to keep very accurate records of maintenance cost and to separate the items of maintenance of shoulders, ditches, culverts and bridges from the one item of maintenance cost of wearing surface proper. The fundamental object is to secure a smooth surface, usable at all times and at a minimum cost. This necessitates a balancing of first cost, interest cost and maintenance cost in such manner as to properly proportion the type of improvement to the amount and character of traffic, with a view of getting unit service cost at a constant rate and at least expense.

FROM MISSOURI.

By FRANK W. BUFFUM, State Highway Commissioner.

Maintenance of roads is a matter of more than ordinary importance and one which is often overlooked in bond issues, which fail to provide for the maintenance of the road pending the time of the maturity of the bonds.

The writer also notes that on the ordinary country

roads, if there was ever a true saying it is "A stitch in time saves nine;" because often on gravel or macadam roads an expense of 10 per cent in the fall will save an expenditure of possibly 50 per cent after the spring season.

The writer is a believer in the patrol system, by which the roads can be maintained by a method whereby each district will take care of a certain mileage. We are talking this all the time and have not yet succeeded in getting it started, but are getting the people to take notice.

MAINTENANCE IN OKLAHOMA

Early Expenditures Wasted Because of Lack of Maintenance—Contract Dragging by Sections—Reports and Records of Dragging.

By W. P. DANFORD, Acting State Engineer, Oklahoma Dept. of Highways.

The 1915 session of the Oklahoma Legislature created the Department of Highways and made provision for the establishing of a state road system. It is required that the board of county commissioners in each county shall select from 10 per cent to 15 per cent of the principal roads in each county, to be known as state roads, such roads to lead from town to town and to be continuous from one county to another. The state roads in each county are to be surveyed by the county engineer and plans and profiles for the road and bridge work submitted to the Department of Highways. After state roads have been designated in a county, no material change in the route is permitted without the approval and consent of the State Department of Highways. Practically all of the counties in Oklahoma have designated their state road systems.

Roads other than state roads are known as township roads. The state roads first designated average about one hundred and eighty miles in each county, and after such designation has been made no addition to the system in the county will be permitted until the entire system has been constructed.

Practically all of the state roads now being constructed are some form of earth roads. Previous to the enactment of the state road law in 1915, many miles of good earth roads had been constructed in Oklahoma, but practically all of this expenditure was wasted for the reason that there were no funds available outside of public subscription for the maintenance of roads. The new road law imposes a tax on motor vehicles, such tax being for the first year 50 cents per H. P. in accordance with the N. A. C. C. rating. The same motor vehicle pays 40 cents per H. P. the second year, 30 cents per H. P. the third year and 20 cents per H. P. each year thereafter. This tax applies to automobiles, trucks, motor-cycles and traction engines, and the money derived from the registration of such motor vehicles is to be used for the maintenance of the state roads. This tax is collected and tags issued by the Department of Highways. Ten per cent of the money collected is retained and goes to the state treasurer and 90 per cent is returned monthly (as it is collected) to the counties from which it came. If there is a city of the first class in the county, that city receives 25 per cent of the 90 per cent of the money received directly from the city.

The state roads in each county are divided into sections and each section is designated by a name, letter or number. If the sections are lettered, the miles in each section are numbered, or vice versa. The road section is, on an average, about nine miles in length or three druggable districts, as ordinarily it is estimated that one man can drag and maintain three miles adjacent to his premises.

The boards of county commissioners are authorized to enter into contracts for the dragging of state roads and for this purpose they use the Oklahoma Department of Highways' form No. 1*, which is a form of contract and bond for the dragging and maintenance of state roads. Each dragging contractor is given a form of monthly report which provides for reporting the several items and the signature of the contractor; each sheet of this report being in duplicate. The contractor is also furnished with a post card report, so that each time he drags the road included in his contract he fills out the post card report and mails same to the county clerk. At the same time he enters the memorandum on his monthly report and at the end of the month tears off the original sheet of his monthly report, retaining the duplicate. The original sheet is mailed to the county clerk, along with his claim for dragging the roads. At the end of the year, if the county commissioners have any money remaining in their drag fund and all state roads that have been constructed have been properly maintained, they may use the balance remaining for construction purposes.

Township boards in Oklahoma must each year select the draggable township roads and appoint a road superintendent whose duty is to properly maintain such township roads. To cover the cost of maintenance of township roads, a two-mill township dragging tax is permitted by law. The form of contract between the township board and their road superintendent is the Oklahoma Department of Highways' form No. 2†.

The new road law has now been in operation in Oklahoma long enough for its effect to begin to be apparent, both to the farmer hauling goods to the market and to persons travelling in automobiles or otherwise. In the past the general impression seems to have prevailed that there was some mysterious way, unknown to the ordinary person, by which good earth roads might be constructed and be everlasting. It is now beginning to dawn on the taxpayer that the secret of success on earth roads is more than half in the maintenance.

IN CALIFORNIA.

By AUSTIN B. FLETCHER, State Highway Engineer.

The California state highway work has been in progress since the spring of 1912, the funds being provided by a bond issue of \$18,000,000 voted by the people.

The maintenance of the state and county roads is taken care of by a fund collected from the license tax on motor vehicles. During 1915 approximately \$1,500,000 was collected. After deducting the cost of licenses and collection, half the money is used for the maintenance of state highways and the other half divided among the counties of the state in proportion to the amount collected from each county for licenses, this amount to be used in the maintenance of county highways.

*This contract requires that he mail, on or before the end of each month, a report giving the date of each rain following which dragging was done, number of miles dragged, number of trips over each mile, type of road surface dragged, number of hours spent, and pay claimed for said work. That he drag the roads only when the moisture conditions of the soil permit a benefit commensurate with the cost of the work done; also that he drag or refrain from dragging whenever directed. That he will use the appliances furnished to him as they were designed and intended to be used, to the best of his ability and intelligence; and to use only such equipment, plan and method as the Highway Department approves, and keep the roadways rounding in shape, with open side ditches. Two bondsmen are required on a \$50 bond.

†This contract provides that the contracting superintendent or supervisor shall contract for and supervise dragging the township roads; keep bridge approaches smooth, culverts and ditches free from weeds and open, and roads rounding; do permanent grading according to county engineer's plans; supervise poll tax labor; report unsafe culverts and bridges; employ necessary assistance at wages approved by trustees; certify bills for dragging, maintenance and repairs; make monthly reports of work done. Also to furnish horses or other motor power at prices included in the contract.

To date the actual maintenance money has largely been expended in the building of macadam or gravel shoulders on the highways already constructed and in the repair of highways in mountainous regions where new cuts have caused slides.

The state highway work in California is too new to furnish valuable data on maintenance costs or system.

IN COLORADO

By THOS. J. EHRHART, State Highway Commissioner.

There are, in round figures, 31,000 miles of public roads in Colorado; the rights of way average about 60 feet in width, or 7 1-5 acres to each mile, making a total of 223,000 acres embraced in rights of way in the state, valued at \$10 per acre, or a total of \$2,323,000.

To fully maintain these roads in their present condition, allowing no depreciation, will cost at least 5 per cent of the total amount invested, or \$1,111,600 annually. I estimate that these roads have cost about \$750 per mile; 5 per cent of the mileage cost would be \$37.50 per mile as maintenance cost. Based on these figures the annual maintenance cost for all roads would amount to \$1,162,500.

The counties raise by local taxation in round figures \$1,500,000, and the state, from all sources, \$735,000 or a total of \$2,335,000; and deducting the maintenance charge we have remaining \$1,172,500 for betterments and permanent improvements.

The question is—would it be a good business proposition for the counties of this state, owning a property so valuable, to pursue the same course that any big business concern does when it annually sets aside a fixed amount for maintenance cost, and another amount to cover cost of depreciation in values? In this case, with proper maintenance, there is no depreciation. The answer is—without a dissenting voice from any source—"certainly we should take care of this maintenance."

The state highway commission is prohibited by law from expending any of the state road fund for maintenance, so that the work devolves upon the county authorities, who generally are aware of the necessity of doing something toward a system of constant upkeep, but in many of the counties the road mileage is great, and the taxable valuation small, requiring a high tax levy to carry on the county government. The road levy in the counties varies from 1/2 mill to 4 mills, in addition to the state levy of 1/2 mill.

We are particularly fortunate in Colorado, as we have much natural road building material, comparatively inexpensive, by combining which we can build the very best of dirt roads.

My plan is to divide our main traveled highways into sections, varying from eight to twelve miles, according to physical conditions, and place a man with a team and proper equipment in charge of each section, whose duty it will be to keep his section dragged, clean the ditches and culverts, and at odd times repair and put on fresh surfacing material. This man can be employed to good advantage for from six to eight months, at a cost of about one hundred dollars per month. No man should be employed longer than he shall give energetic, intelligent and efficient service. No inquiry should be made as to his politics, and no hesitancy in his discharge for poor service.

Traffic census taken on the Denver-Colorado Springs road during August and September, 1915, shows that the average automobile travel for 41 days was 168 local automobiles and 85 out of state cars per day, or a total of 6,909 Colorado cars, and 3,482 foreign cars, and a grand total of 10,391 cars.

IN NORTH DAKOTA.

By J. W. BLISS, State Engineer.

The road laws of North Dakota have to a large extent outlived their usefulness, and it is generally appreciated that most of the road work done within the state under our existing laws is inefficient.

North Dakota has now approximately 60,000 miles of roads of all kinds outside of the corporate limits of cities and villages. Of this mileage it is estimated that 26,000 miles are turnpiked, 1,100 miles graveled and 33,000 miles are ordinary prairie trails. The average, then, for each county in the state is as follows:

20 miles of gravel roads,
500 miles of graded roads, and
640 miles of ungraded roads, or

a total average of 1,160 miles.

Heretofore the state has paid little attention to the maintaining of the roads that have been built. The need for new roads seemed so imperative that township and county boards felt that they were not justified in diverting any funds from construction to maintenance. However, the time has come in North Dakota when the maintaining of the roads that have been built is of just as much importance as the building of new roads. The county commissioners and township officials are now planning on doing a considerable amount of maintenance work.

The highway commission has consistently urged upon boards having authority the necessity of keeping the roads that have been built in first class condition.

There are no laws regulating the maintenance of roads in this state, and the amount of time and money that may be devoted to this work depends upon the judgment of the county and township boards. The state highway commission is nominal only and can only act in an advisory capacity.

North Dakota will not be building more permanent types of roads, but only earth and gravel, for a number of years to come, and the maintenance question is and will be one of the utmost importance.

IN OREGON.

By JOHN H. LEWIS, State Engineer, Oregon State Highway Department.

The Highway Department in the State of Oregon is still on trial, has only been in existence two full seasons and only a very small allowance is made for the work which it is expected to handle. The State funds allotted to this department are less than \$240,000 a year.

There was a big demand for new road work in certain portions of the state in order to have a certain trunk system throughout the state, so that all our money has been spent on construction work. We have been given supervision over certain funds representing bond issues by a few counties, and this also has gone into construction.

After the department constructs the highway, it is turned over to the county to take care of the maintenance problem. A short time ago, owing to a misunderstanding in some of the counties as to so-called "state roads," the attached resolution was adopted by the State Highway Commission and sent to all the counties through which construction work has been carried on.

Resolved, that the Engineer of the Highway Commission is hereby instructed to notify County, that the State Highway Commission and its employees assume no responsibility for the maintenance of Road or Roads, except as by special arrangements which it may obligate itself so to do, and that the burden of responsibility for the maintenance of upkeeping of said

road or roads is in the hands of the county officials of the county, in which said road or roads are located.

That there may be no possibility of misunderstanding as to the relative responsibility of the State and County for the care and maintenance of said road or roads, the County Court receiving this notification is hereby requested to acknowledge receipt.

It is quite probable that there will be some amendments made by the next Legislature which meets in January, 1917, affecting the present highway law, and there is also a growing sentiment in the state for more funds with which to carry on the work of this department, and there will undoubtedly be some provision made for the maintenance of roads which are constructed by the State of Oregon and which form a part of the state trunk highway system.

WASHINGTON LAW RE. MAINTENANCE.

By THOS. G. BUSH, Assistant State Highway Commissioner.

The law of Washington provides that all primary state roads shall be maintained by appropriations made by the state legislature and under the supervision of the State Highway Department. Seven and one half per cent of the total appropriations made for survey, construction and maintenance has been set aside for maintenance. For the biennium beginning April 1st, 1915, this amounts to \$208,736.77, and is apportioned in the various sections by the State Highway Board.

NEW OLD TRAIL BRIDGE.

A new bridge has been completed on the National Old Trail Highway which spans the Colorado river between Needles, California, and Topock, Arizona, which will be greatly appreciated by motorists in southern California and the southwest generally. Heretofore it has been possible to get an automobile across the Colorado at this point only by paying a toll of \$3.50 for the privilege



BRIDGE ACROSS THE COLORADO AT NEEDLES.

of using a railroad bridge; in which case special permission was necessary and the train dispatcher also remained to be dealt with.

The general type of the bridge is shown in the accompanying photograph. It is said to be the only one of its kind in the United States, although there is a similar one in Switzerland. The bridge is 532 feet long and 125

feet above the surface of the river. It cost about \$75,000. It was planned and constructed by the Department of the Interior and the State Railroad Commissions of California and Arizona. It was dedicated with appropriate ceremony on Saturday March 25th, when highway commissioners, state engineers and several hundred citizens attended.

ASPHALT-IMPREGNATED BRICK.

In 1893 there was laid on Stark street, Portland, Oregon, a section of pavement composed of paving brick which had been boiled in coal tar before being laid. This brick remained in service for 17 years. Some years later the same idea was used in Los Angeles, where the street railway company laid alongside the rails brick nose-blocks which had been boiled in asphalt. This was nine years ago. Three years ago there was laid at the corner of Second and Market streets, San Francisco, 2,500 bricks of the same kind in the street railway strip. Along the same strip, continuing from one end of this section, was laid a section of basalt block, and in the other direction a section of sheet asphalt. It is reported that the treated brick after more than two years' use showed less wear than either basalt block or the sheet asphalt adjoining, although the treatment, namely, the boiling of the bricks in asphalt, caused the asphalt to penetrate only $\frac{1}{2}$ inch to $\frac{3}{4}$ inch below the surface. Similar brick soaked or boiled in bitumen have been laid in Nashville and Chattanooga, Tennessee.

These treatments were more or less crude, but the results obtained seemed to indicate that there was merit in the idea. The bricks were, as might be supposed, practically impervious to water, and laid with a filler of the same bituminous material made an impervious pavement; while other even more important advantages seemed possible if the process could be developed scientifically. Such development, it is claimed, has now been made, and a brick is being placed on the market which is impregnated throughout with an asphaltic preparation, using in the treatment from 6% to 15% of the weight of the brick.

The advantages claimed for a pavement laid with such brick are that it is impervious to moisture—that the asphalt filler used adheres more firmly to the asphalt-impregnated brick than to any vitrified clay surface, thus preventing the opening of the joints and making the pavement a monolithic bituminous pavement, possessing all the advantages claimed for brick pavement. That it is more noiseless than an ordinary brick pavement, even where such pavement is laid with bituminous filler. Being impervious, no objectionable liquids are absorbed by the brick or filler, making for sanitation. There can be

no expansion due to moisture in the pavement surface.

More important, it would seem, is the wearing quality, which characteristic is revealed by the rattler test. Bricks of a number of makes were tested, and in each case such bricks were selected as would not pass under city specifications as No. 1 pavers. (This should be borne in mind; the abrasion losses of the untreated brick, as stated in the table below, were high and not typical of the bricks which these firms would sell as paving bricks.) It is seen that while the rattler loss of the untreated brick ran from 23% to 62%, that of the treated brick was in almost every case between 13% and 16%. This apparently means that a brick which has not been burned to the point of vitrification can be made by this treatment to give an abrasion loss lower than any engineer would think of specifying for the best grade of vitrified brick. Also that almost all brick of wide variation in hardness will be brought to a remarkable uniformity as to abrasion loss or wear. Apparently the impregnating asphalt, by its adhesiveness, prevents the brick from losing particles which would break off of an untreated brick; and it is claimed that when laid in a pavement this advantage would be more marked and that the bricks would neither chip or spall, but brittle paving brick would become by treatment practically a malleable product.

From the manufacturers' point of view, such treatment would apparently enable him to stop his burning at a considerably lower point than is now necessary for No. 1 pavers, and to sell as No. 1 pavers all or practically all of every burning, instead of 60% to 70%, as is now the case. In the manufacture of asphalt-impregnated bricks, the burning, as ordinarily conducted, would be stopped two or three days sooner than for vitrified pavers. The brick would be cooled down to a handling temperature and run on low trucks into a tight cylinder. A vacuum of 25 inches is produced in the cylinder to insure the removal of all air. (This vacuum is applied while the bricks are at a temperature of approximately 350°F.) Meantime, the asphaltic material has been heated in a tank and is now discharged into the cylinder, filling it to a point above the bricks, and a pressure of approximately 160 lbs. per square inch is produced in the cylinder and maintained for from one to three hours, as may be required. By opening a valve in the pipe draining the cylinder, all surplus asphalt is then returned to the asphalt tank. The bricks are then taken out and run into an annealing chamber, where they are allowed to cool. A batch of bricks can be treated every two to three hours.

An examination by the writer of this article of a number of the treated brick referred to in the table showed that, so far as could be judged, there was uniform impregnation of the entire brick.

COMPARATIVE TESTS OF SHALE AND CLAY BRICKS UN-TREATED AND TREATED BY ASPHA-BRIC CO.'S PROCESS.

These tests were all made in standard rattler as specified by the National Paving Brick Manufacturers Association, tests in all cases being made by Robert W. Hunt & Co., Engineers. In each test ten bricks were used, 5 treated and 5 untreated, all in the rattler at the same time and under the same conditions. Weight of abrasive material as follows: small shot, 225 lbs.; large shot, 75 lbs. Number of revolutions 1,800 at rate of 30 R. P. M. Each brick weighed separately before and after test.

Brick.	Type.	Size (Inches)	Wt. before test—lbs.		Wt. after test—lbs.		Loss in Wt.—lbs.		% Loss in Wt.		Number of brick broken.	
			Un-treat.	Treat.	Un-treat.	Treat.	Un-treat.	Treat.	Un-treat.	Treat.	Un-treat.	Treat.
Sterling Brick Co.....	Dunn W. C. L.	8 $\frac{1}{2}$ x 4 $\frac{1}{4}$ x 3 $\frac{3}{4}$	50.66	56.75	23.64	48.37	27.02	8.38	53.34	14.77	1	0
C. E. Poston	Repressed	9 $\frac{1}{4}$ x 4 $\frac{1}{2}$ x 3 $\frac{3}{4}$	48.81	54.01	31.42	45.05	17.39	8.96	35.63	16.59	0	0
Terra Haute	Dunn W. C. L.	9 $\frac{1}{4}$ x 4 x 3 $\frac{3}{4}$	46.50	48.97	17.69	42.75	28.81	6.22	61.96	12.70	3	3
Clinton Pav. Brick Co....	Dunn W. C. L.	9 $\frac{1}{4}$ x 4 $\frac{1}{4}$ x 3 $\frac{3}{4}$	53.35	55.77	36.16	45.70	17.19	10.07	32.22	18.06	0	1
Mack Mfg. Co.....	Dunn W. C. L.	8 $\frac{1}{2}$ x 4 x 3 $\frac{3}{4}$	45.25	47.49	31.32	40.98	13.93	6.51	30.79	13.71	0	0
Corning Block	Repressed	8 $\frac{1}{2}$ x 3 $\frac{3}{4}$ x 3 $\frac{3}{4}$	48.65	51.33	36.77	44.50	11.88	6.83	24.42	13.31	0	0
Jamestown Shale Pav. Co..	Block	8 $\frac{1}{4}$ x 4 $\frac{1}{4}$ x 3 $\frac{3}{4}$	49.75	54.60	30.18	47.24	19.57	7.36	39.34	13.48	0	0
Hocking Valley Brick Co..	Dunn W. C. L.	8 $\frac{1}{4}$ x 4 x 3 $\frac{3}{4}$	47.95	49.94	34.32	43.48	13.63	6.46	28.43	12.94	0	0
Metropolitan Block.....	Repressed	8.85 x 3.58 x 4.03	50.03	54.53	38.25	48.28	11.78	6.25	23.55	11.46	0	0
Averages			48.99	52.60	31.08	45.15	17.80	7.45	36.63	14.11		

NOTE—All bricks were made from shale except those of the Mack Manufacturing Co., which were of fire clay and shale. In each case bricks of the same quality and from the same batch were used in the comparative tests of treated and untreated bricks and were in all cases "Seconds."

RECENT DEVELOPMENTS IN THE BUILDING OF CONCRETE ROADS*

Conclusions from Construction of Twelve-Mile Model Road—Duration of Mixing—Expansion Joints—Reinforcement—Curing.

Road authorities are paying more attention today than ever before to the details of construction, in an endeavor to find a form or type of construction that not only will withstand present-day traffic, but which also will be economical in first cost and low in maintenance charges. With this object in view, experimental and service test roads are being built from time to time.

To determine the practicability of such construction, and to assist in standardizing the best design and most approved methods of construction, the Pennsylvania State Highway Department has undertaken, with the co-operation of the cement interests, to build a model concrete road between Easton and Allentown, approximately 12 miles in length.

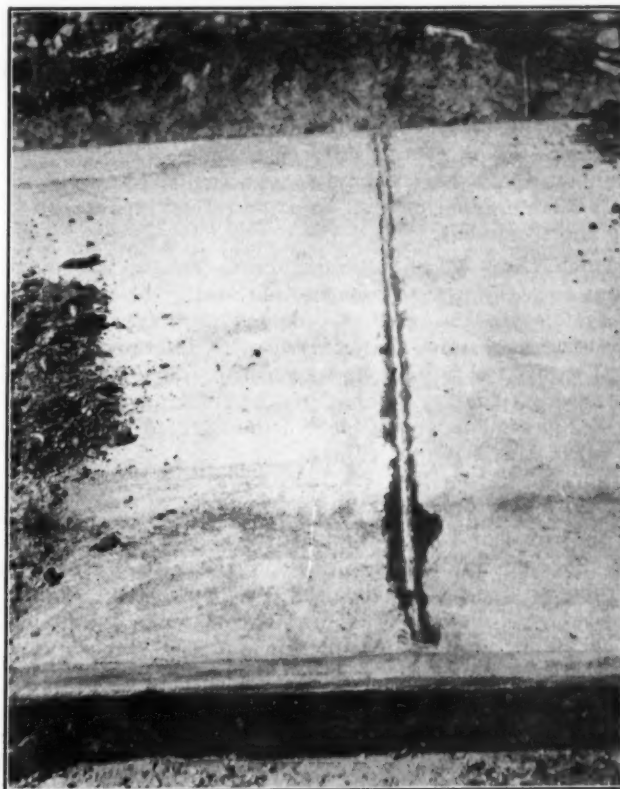
In the construction of this highway, which is not yet completed, especial attention is and has been paid to every engineering detail, starting with the subgrading and drainage, thorough rolling of subgrade before placing materials, proper grading of aggregates, the exact proportioning of materials and the amount of water used. Other details closely watched are the timing of the mix, laying of the concrete, striking off and curing of the pavement.

After the subgrade is finished accurately, drained and rolled, the forms are placed, which consist of 6-inch channels in 12-foot lengths, held in place by steel pins; particular care being taken to have the alignment and grade of these forms accurate. Steel forms are being used both for economy and on account of the ease with which they can be handled.

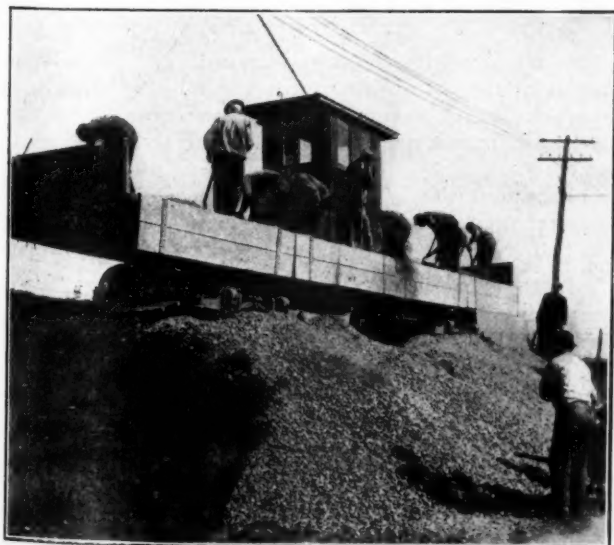
To eliminate the re-handling of materials, a system was devised for the proper distribution of the aggregate and cement. On this work all materials have been

stone at measured intervals. Portable canvas sheds holding 90 sacks each, used for the storage of the cement, were placed at measured distances along the route, and as emptied were moved ahead.

In proportioning the batcher, the sand and stone were handled in specially devised wheelbarrows of 3 cubic feet capacity to insure accurate measuring, and when loaded these barrows were struck off with a shovel. The same care has been given with reference to the amount of water used in each batch, just enough being put in



FABRIC JOINT IN PLACE.



UNLOADING BROKEN STONE FROM TROLLEY CARS ALONG LINE OF WORK.

brought to the point of use on trolley cars, advantage being taken of the fact that the car tracks paralleled the full length of the road, making it by far the most economical way of handling the materials. This method of delivery proved advantageous for unloading sand and

to secure a plastic mixture which would not quite level down in the bucket or when dumped.

Every batch of concrete is mixed for one and one-half minutes; the reason for this being that a number of experiments, made during the progress of the work, indicated that the greatest strength, commensurate with economy in cost of mixing, is obtained from a mix of this timing. The experiments which resulted in this conclusion were as follows:

One-half-minute mix, 9 revolutions, 8-day test, 1,400 lbs. per sq. in.

One-minute mix, 17 revolutions, 8-day test, 1,587 lbs. per sq. in.

One-and-one-half-minute mix, 26 revolutions, 8-day test, 1,624 lbs. per sq. in.

Two-minute mix, 35 revolutions, 8-day test, 1,661 lbs. per sq. in.

Three-minute mix, 51 revolutions, 8-day test, 1,673 lbs. per sq. in.

This shows that if these results are plotted, the curve would break between the one-and-one-half and the two-minute periods. If the accuracy of the results on the one-and-one-half-minute mix be questioned, and this figure assumed to lie between 1,587 and 1,661, the results plotted so as to form a curve will show that the rate of increase in strength decreases with increase in the time of mix, and the increase obtained from the two and three-minute periods is scarcely worth the additional time and cost involved.

*Paper before the American Road Builders' Association, by William D. Uhler, Chief Engineer Pennsylvania State Highway Department.

Another feature that has been brought out in connection with this work is the great variation in strength of six-inch cubes of the regular mix, made up daily during the progress of the work and set aside for testing at periods of seven, fourteen and twenty-eight days, and six months.

The seven-day compression test runs from 1,065 to 3,633; the fourteen-day test, from 1,572 to 4,212; the twenty-eight-day test, from 2,362 to 5,361. As yet, no six-month breaks have been made.

These wide variations in strength values may be due to a combination of several causes, including variations in the quality of the cement and mineral aggregates; difference in storage temperature (some of the specimens having been made up during warm weather and some during very cool weather); possible slight differences in the mix, and differences in the molding and compacting of the specimens; and finally, of course, the unavoidable experimental variation in making and breaking the specimens.

Since every one of these factors, except the last named, enter into the actual construction work, the importance of systematic testing of the cement used, examination of the sand and stone (particularly with reference to grading), and strict adherence to uniform, approved methods of mixing, placing, compacting, and curing the concrete in the pavement, are forcibly demonstrated by the range in these daily strength values.

Before placing the concrete, the subgrade is thoroughly sprinkled; after which the concrete, mixed in the proportions of 1:2:3, is placed to a depth of six inches at the side and eight inches in the center, and then struck off with strike boards. A heavy strike board is used first, followed by a lighter one, which results in the compacting of the concrete and the elimination of waves or rolls in the surface. The striking off always should be done in the same direction as the progress of the work. When the strike board has reached to within three feet of the joints, it is lifted and placed alongside of the joint filler, or installing bar, and then worked away from the joint. This avoids the danger of piling up material around the joint or pushing the joint out of perpendicular. Joints which are not perpendicular may cause unevenness, due to one slab rising on another. Proper striking off puts the surface in condition to be finished with the least amount of labor, as well as making it possible to secure an even, true and dense pavement.

After the water has disappeared, the surface is floated with a wooden float. Too frequently it is the case that the floating is done prematurely, and this has a tendency

to bring to the surface the fine light particles which offer little, if any, resistance to abrasion.

Joints $\frac{1}{4}$ inch wide are provided at intervals of from 36 to 40 feet. These are filled with a prepared bituminous material $\frac{1}{4}$ of an inch thick and 9 inches wide, placed in accordance with the standard practice of today. The concrete on either side of the joint is finished with a split float, which gives a surface of even height on both sides of the joint and overcomes, to a great extent, the so-prevalent rough riding joints. The edges of the joints are then rounded with a $\frac{3}{16}$ -inch edger to prevent the spalling or breaking of the edges. The bituminous joint material is trimmed off about one inch above the finished surface, which permits traffic to beat down the projecting filler, thus forming a protection to the edges.

The sides of the slab are then rounded with a $\frac{3}{4}$ -inch edging tool, which not only adds to the appearance of the work, but serves to protect the sides and prevents chipping by traffic turning on and off the road.

There is a vast difference of opinion as to the advisability of using protection plates at the joints. Experience leads me to believe that if proper care is taken in the maintenance of the unprotected joints, built as outlined above, far more satisfactory and economical results will be attained than by the use of steel joints, especially if there is any difference in the rate of wear of the concrete and the steel in the joints. Only a thousand feet of this road has been constructed with steel protection joints, and up to the present time no advantage in this method of protection is noticeable.

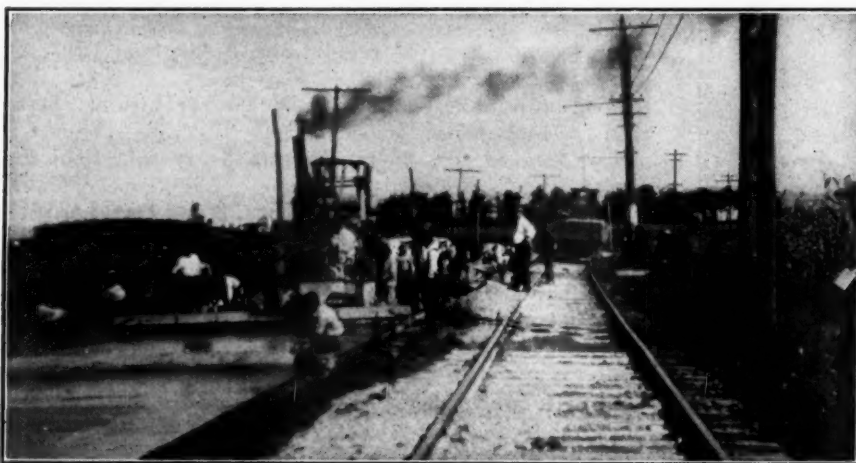
The road in question, although of six-inch and eight-inch construction, is reinforced also with a light metal fabric, which is shipped to the job in sheets 5 feet in width and 6 and 10 feet in length. This is placed with longitudinal joints staggered and with a lap of 4 inches crosswise and 12 inches longitudinally. Of course, it would be preferable if sheets could be obtained the full width of the roadway. Reinforcing shipped in sheets, in my opinion, is more satisfactory because it is easier to handle and can be installed with less trouble, while with the rolls there is bound to be more displacement of the concrete when the workmen endeavor to force it into place.

This metal reinforcement is placed two inches below the top of the slab. It reduces the number and size of the cracks and is designed also to overcome longitudinal cracks which may occur because of the settlement of the shoulders.

Throughout the West the general practice is to build concrete roads without reinforcement 6 inches at the side and 8 inches in the centre. Personally, I believe that far better results can be obtained at the same cost,

and under some conditions at less cost, by the construction of 5-inch and 7-inch concrete roads with light metal fabric reinforcement.

In order to secure the maximum strength and wearing qualities, special attention is given to the curing and protection of the concrete pavement. During hot and windy weather the fresh concrete is covered with canvas as soon as possible after floating. To keep the canvas off the fresh concrete, portable forms were constructed, which could be taken up and set along the edges of the pavement, projecting about twelve inches above the pavement, on which the canvas covering, which was on two rollers, was easily unrolled. This method of handling the canvas covering proved very satisfactory. After



FLOATING PAVEMENT. MIXER IN ACTION. TROLLEY CAR DELIVERING MATERIAL.

the concrete had had sufficient time to harden, the canvas was removed, and the pavement covered with from two to three inches of earth and kept wet from ten to fourteen days. The ponding method of curing, employed by the Highway Department of California, consists of flooding the pavement and is more economical and far more satisfactory, but, due to the character of our soils, it is not practicable in this section of the country.

At the expiration of the fourteen-day limit, the earth covering was removed and the road thrown open to traffic.

Of this twelve miles just described, a section about three and one-quarter miles in length was completed last season. An inspection made recently shows that thus far only two slight cracks have developed in the pavement.

Other experiments will be made on this work during the coming season, with reference to the time and speed of mixing and also the water consistency.

In order to make a more complete study of the cause of cracks in concrete pavements, three lines of precise levels have been run, taking elevations at each end of every slab, at each corner, and in the center. This should give us some valuable data, and in case longitudinal cracks occur, enable us to determine whether there has been a heaving, due to frost action, or a settlement of the shoulders.

Finally, I would say that the essential features for a good concrete pavement are a hard, dense surface, true to grade and cross section, free from waves, depressions and irregularities, and one which will insure uniform wear.

ROCK ASPHALT ROADS IN KENTUCKY.

Although the first roads to use asphalt as a paving material, it is believed, employed rock asphalt, which is still the form most commonly employed in Europe, a comparatively small amount of asphalt pavements in this country have been laid with this naturally prepared material, most of our asphalt pavements employing artificially mixed asphalt and sand. There are, however, considerable deposits of asphalt-impregnated rock in this country, both limestone and sandstone. The largest quarries of sand rock asphalt, we believe, are found in Kentucky, and the rock from these has been used not only in various parts of that state, but in several other states, one road as far distant as Florida having been treated with this material. It is principally in Kentucky, however, that the material is now being used, and especially in the county and state roads, although some work has been done in one or two cities, as for instance in Louisville, as described in our issue of September 2nd, 1915.

In a recent symposium on road building in Kentucky, Samuel Greene, judge of Jefferson county (in that state road work is in charge of the county courts), stated: "The Kentucky rock asphalt road, of which several miles have been tried during each of the years 1914 and 1915, appears to be satisfactory, and the 1914 road required little expense for maintenance during 1915." Magistrate Joseph Muenninghoff, of Jefferson county, stated that the experience with rock asphalt on Taylor Boulevard in 1914 led to the adoption by the court in 1915 of this material for the Louisville and Nashville turnpike, now a part of the Dixie Highway, about four miles of road 16 feet wide having been laid during 1915.

Fayette county has a stretch of rock asphalt 12 feet wide and something less than a mile long, which County Engineer R. W. Davis says cost 46 cents per square yard, including the scarifying of the old limestone road, adding

new stone to the subgrade, and the rock asphalt surface on this. This particular road is on a highway leading into Lexington over which several million tons of tobacco was hauled in 1915, on tires less than 2 inches wide, this hauling being done only in wet weather, which makes it especially severe on the roads. Frank A. Bullock, county judge of Fayette county, experimented with rock asphalt on a half-mile of the Russell Cave pike about a year ago. It is his idea, if the material should prove as satisfactory after a test of two or three years as it has been so far, to have the county buy a rock asphalt quarry and operate the same; or, failing this, to contract with the company which controls the Edmonson mine for that needed by the county for resurfacing its roads.

MERITS OF ASPHALT ROADS

The relative merits of bituminous roads built with the use of the so-called natural asphalts and of those obtained from asphaltic oils were presented at a road congress in two papers, each prepared by a chemist connected with a company dealing in these two kinds of asphalt respectively. In order that the claims of both may be learned and compared, the two papers are presented below (somewhat condensed) and should be read together.

MERITS OF NATURAL ASPHALT ROADS*

By CLIFFORD RICHARDSON†

The merits of any type of road surface depend upon the design, the skill employed in construction, foundation, drainage, character of the materials and the method of construction. The merits of any bituminous material used are determined eventually by service tests extending until the life of the road surface has been demonstrated. The merits of the bituminous material may also be inferred by a study of the physical properties of the bitumen and of the bitumen combined with suitable mineral aggregates. Natural asphalts—the particular materials assigned as the subject of this paper—are, with the exception of gilsonite and grahamite, the only more or less solid bitumens occurring in nature which are of commercial importance. They are obtained from the so-called lakes on the Island of Trinidad and in Venezuela, and are used in various types of road surfaces. The merits of Trinidad asphalt have been demonstrated by service tests extending over nearly forty years. It is a material containing a very uniform percentage of very finely divided mineral matter, a considerable proportion of which is clay in a highly dispersed colloidal condition. Bermudez asphalt is a much purer bitumen, and because of its convenience in handling is more readily used in the construction of broken stone surfaces.

Natural asphalt was first employed in the construction of monolithic street surfaces with sand aggregate about forty years ago. The success of this work and improvements in methods of construction introduced about twenty years ago led to the use of the material as a binder for broken stone country roads.

The merits of natural asphalt for building broken stone roads have been demonstrated in Massachusetts perhaps more thoroughly than any other locality. The first broken stone surface in which natural asphalt was used as a binder was laid on Western Avenue, Gloucester, in 1909.

Two methods of construction are in common use for the construction of asphaltic broken stone roads. In one—the mixing method—the stone is coated with asphalt before it is placed on the road, and in the other—the penetration method—the stone is spread and the asphalt subsequently applied. In Massachusetts natural

*Slightly condensed from paper before the Worcester, Mass., Road Congress.

†Consulting Engineer. Barber Asphalt Paving Co.

asphalts have been used by both methods. During recent years the penetration method has been preferred for reasons which seem satisfactory to local engineers, among these reasons being the availability of mechanical distributors. It might seem at first that the careful mixing of dry stone and cementing material could be more readily accomplished by the mixing method, and this is true to a certain extent. But the stone, especially if hot when mixed, will carry a film of bitumen of only a certain degree of thickness. Any excess will run off, especially if the binder lacks viscosity when melted. By the penetration method, on the other hand, a larger amount of bitumen can be introduced into a road surface, if it is sufficiently viscous in a melted condition to remain well distributed. This enriches the surface to a degree impossible by the mixing method.

A Massachusetts engineer of extended experience has said: "Under certain conditions the penetration method, using a natural asphalt binder, will produce roads fully as satisfactory as are obtainable with the mixing method, if proper attention is given to construction details." This is the opinion of one who has had experience with both methods, using natural asphalts, and his conclusions are the results of service tests of roads of both kinds. These conclusions do not agree with those of some engineers who have based their conclusions on the use of less viscous materials which are so liquid that they will not stay in place.

In the construction of asphaltic broken stone surfacings by the penetration method, it has been demonstrated, especially by the writer's observations in Massachusetts and on Long Island, that the size of the stone is of great importance and that it should be as large as $2\frac{1}{2}$ ins. Such stone gives greater stability than smaller material and permits a more satisfactory introduction of the binding material. Moreover, it can be used satisfactorily by the penetration method, but not by the mixing method, on account of the difficulty of handling large stone in mechanical mixers.

Massachusetts experience has also shown that the more viscous natural asphalts can be used in larger amounts per square yard of surface than can less viscous asphalts which are more susceptible to temperature and would be drawn to the surface by the sun if used in larger quantities. Based upon Massachusetts experience, the amount of natural asphalt used should be 1 gal. per inch thickness of stone, aside from that employed in the seal coat. Such a road is rich in bitumen, possesses greater resiliency and is more resistant to wear.

Another strong argument in favor of the penetration method is that the cost of construction is from \$3,000 to \$4,000 per mile less than by the mixing method. This not only saves in first cost, but also an interest charge of from \$150 to \$200 per year.

In considering, therefore, the relative values of the mixing and the penetration methods, when natural asphalts are used, the following advantages in favor of the penetration method must be borne in mind: (1) Larger stones can be used in the penetration method than in the mixing method; (2) a more elaborate and extensive plant is required for the mixing method than for the penetration method; (3) the penetration method allows the use of a greater quantity of binder, which acts as a reservoir for the enrichment of the surface; (4) natural asphalts when present in some excess are not susceptible to high temperatures and the road does not bleed.

Evidence favoring construction with natural asphalts by the penetration method is well presented in two recent articles—"The Comparative Value of Penetration Roads," by D. T. Pierce, "Good Roads," November 6, 1915, and "Bituminous Penetration Roads in Massa-

chusetts Equal Those Built by the Mixing Method," "Engineering Record," May 15, 1915.

In the United States sheet asphalt has rarely been used in surfacing roads, but its suitability for this purpose has been recognized in England for main highways carrying heavy traffic. As time elapses and funds become available, it will, no doubt, be adopted here. In England the surface is laid on a close binder, supported by excellent old macadam surfaces which form satisfactory foundations.

Stone filled asphalt surface mixture, laid with natural asphalts as binders, and sometimes called asphaltic concrete or Topeka mixture, is a highly satisfactory surface even for heavy travel. It consists of a standard sheet asphalt surface mixture, combined with broken stone less than $\frac{1}{2}$ in. in diameter and having an amount of surface mixture more than sufficient to fill the voids in the stone. The success of this construction depends upon the care exercised in the grading of the finer portions of the aggregate. To any standard sheet asphalt mixture, stone of pea size is added with sufficient additional bitumen to cover the surface of the stone. The merits of this material lie in its economy, since, owing to the presence of the stone, a smaller percentage of the bitumen is required. In such a place as Riverside Drive in New York City, this type has withstood heavy motor-bus travel satisfactory and seems to have a considerable future before it where proper materials are available for the aggregate.

The merits of natural asphalt roads, aside from their durability, are those common to all smooth surfaces, with the addition that, when properly constructed, their maintenance can be readily carried out with simple appliances.

It may be said, in conclusion, that the value of any material or form of construction can be demonstrated only by service tests. Experience and the actual financial return for the travel carried are the sole criteria upon which to judge any road surface.

MERITS OF REFINED ASPHALT ROADS.*

By LEROY M. LAW†

The subject, "The Merits of Refined Asphalt Roads," would hardly have been a welcome assignment five years ago, and, in fact, any discussion along such lines would have had to be of a prospective nature, and of little promise, for most service experiences had proven failures and an inadequate chemistry offered little ground for optimistic predictions from the laboratory standpoint.

The "Merits of Refined Asphalt Roads" resolves itself into the merits of the asphalts used, for in the same type of construction the other factors will be practically the same for all asphalts.

The evolution of any product depends upon two factors—raw materials and process of manufacture. Petroleum doubtless entered the paving industry as a flux or softening agency for the solid native bitumens which were too hard to use in their natural conditions. These fluxes were not straight mineral oils, but the residue or by-products of the distillation of petroleum to secure burning oils and, later on, gasolines and lubricants. The fluxes were what remained in the still and, under the name of "residuum," were generally considered to contain the lubricating oils, waxes and pitch base. That they were refuse products is shown by the fact that oils were frequently subjected to the so-called cracking process for an increase over the normal yield of burning oils, this being done to the detriment of the residuum.

*Slightly condensed from paper before the Worcester, Mass., Road Congress.

†Chief Chemist, United States Asphalt Refining Co.

There are about six oil fields in this country, and though the oils in some of them vary from well to well, they were practically all distilled for the same major products. It was not surprising, therefore, that the residues were variable and sometimes unsuited even for fluxes.

The increasing use of the more successful native bitumens early became the stimulus for the development of the residuals so that they might compete with the asphalts, and to do so it was necessary that they be brought from their more or less fluid state to consistency suitable for paving purposes. It was early found that distilling paraffin and semi-asphaltic petroleum beyond the "residuum" stage resulted in the decomposition of the pitch or asphalt residues to such an extent that they could not be seriously considered as paving materials, so other means were sought to achieve the desired end. It was found by Dubbs that adding sulphur to the residuum, maintained at elevated temperatures, resulted in a molecular condensation with the liberation of sulphuretted hydrogen gas. The resulting artificial asphalts were called "Pittsburgh flux." At about the same time, Byerly found that blowing air through heated residuum accomplished similar results, and in 1893 took out a patent covering the air blowing process. This proved a most important step, as air blowing was cheaper than the sulphur process, and by regulating the duration of the "blow" asphalts of varying consistency could be produced. Materials produced by this process have proved successful, though they made no serious inroads on native bitumens for paving purposes.

Another step in the evolution of asphalts from petroleum was taken by compounding with the distillation residues hard bitumens like gilsonite and grahamite so as to produce materials of paving consistencies. Many of these compounds contained as much oil as a hard bitumen, and the air blowing process was frequently involved in their manufacture. Several rather successful asphalts of this character have appeared on the market in recent years. Because of the large percentage of oil residuum required, the character of the finished product is uncertain, and this, together with the high price of gilsonite and grahamite and other factors, doubtless served to restrict the use of such preparations.

This brings us up to about 1900, previous to which oil asphalts were purely artificial materials, being, at best, prepared from oils of low asphaltic content and their solidity and consistency depending upon the method of manufacture. It was probably only to be expected that they would be called by such names as manufactured asphalts, oil asphalts, residual asphalts and the like, though such designations are not appropriate to the totally different types that followed.

Asphalts from Texas and California petroleum next deserve attention, and it is interesting to note that while they differ widely in characteristics, both are still in use. The original Texas asphalts, being blown, were low in susceptibility to temperature changes, but their low ductility retarded their adoption where specifications called for a minimum ductility of from 15 to 20 centimeters. California materials, on the other hand, possessed practically unlimited ductility, for, being obtained from full asphaltic base oils, the blowing process could be omitted. This fact renders their advent the turning point in the evolution of petroleum asphalts, as they could be prepared by a simple refinement direct to the desired consistency. Although there has been some lack of uniformity in the crude supplies and their high susceptibility has sometimes been considered objectionable, they have been quite successful and are still in use.

The ideal raw material for the production of petroleum asphalts became available about five years ago,

when the Mexican petroleum entered the field. The material was ideal because the asphalts produced met successfully recognized tests and the supply was plentiful and uniform. These asphalts had appeared in the paving industry years ago, but the earlier oils were more or less solidified effusions from the real supply, which lay thousands of feet below the surface. The opening of several large wells on the east coast of Mexico in 1910 marked the beginning of a new epoch in the asphalt business, as a large supply and reasonable water transportation rates soon made it possible to market the material at a favorable price.

The two types of Mexican petroleum brought to this country are in general a heavy oil of from 10 to 12° Be. gravity, carrying about 70 per cent. of asphalt, and another of 18 to 21° Be. gravity, carrying from 55 to 60 per cent of asphalt. These come from wells 3,000 to 5,000 ft. deep, are collected and then pumped into specially constructed tank ships for transportation to the refineries in this country. Both oils yield excellent paving materials. Their high asphalt contents and correspondingly low percentages of light oils permit prompt refinement with a minimum risk of injuring the residues, which in handling the Mexican petroleum are the major products of the refinery. With either type of crude, it is commercially practicable to stop the refining process at any stage of consistency so as to give the engineer a material made by one simple process. By this means the natural fluxes are retained and subsequent artificial fluxing is unnecessary.

For paving cements and road binders there is apparently a preference for the products of the heavier oils, probably because of their greater density and lower paraffin content. The lighter oils, however, serve as the chief source for road surfacing materials. When simply freed from moisture and sediment, they serve as cold surface dressings, while deprived of the lighter oils they serve for the more permanent and so-called hot surface applications. That the merits predicted for the materials by scientific tests have been verified is evidenced by their use in many cities for sheet asphalt and asphaltic concrete. In many cities the pavements have successfully passed into their fourth year of service. The uses of Mexican products have been even more general in road construction and treatment than in street pavement work, as evidenced by work in Maryland, Massachusetts, New York, New Jersey, Pennsylvania, Illinois, Maine, Virginia and New Hampshire and in the Canadian provinces. Such recognition of asphalts from Mexican petroleum shows that the early conceptions of "oil asphalts" are fast being obliterated; certainly they indicate that the character of the material itself is to be considered rather than the classification in which the material may be placed. In this connection, attention is called to the decision of the Supreme Court of the State of New York to the effect that asphalts prepared from Mexican petroleum are to be considered in every respect natural asphalts.

With the entry of California materials into the field, the possibility of simplifying the process of preparing petroleum asphalts was noted. This was because the oils themselves were rather fluid asphalts than mere oils. A high asphalt content with a corresponding reduction in the amount of burning oils brought about a complete change of purpose and what had been the "residuum" or residue became the major product. This is the case today in the refinement of Mexican petroleum; every possible care is taken to preserve the asphalt constituents, leaving as the refuse or by-products the volatile oils, which are sold for fuel and gas making purposes. This change has brought forth several new

processes, among which may be mentioned those covered by the Dundas and Trumbull patents. The former is little used, but the latter is in successful operation for both California and Mexican oils and is worthy of mention. This operation depends upon preheating the oil, then pumping it to the top of heat-jacketed, cylindrical towers and allowing it to run down the inner surface of these in a thin sheet. Around a central vertical standpipe or off-take are openings through which the lighter oils pass to the condensers. The consistency of the asphalt produced is controlled by the temperature employed and the rate of pumping.

The most generally used process is that of steam distillation, which removes the lighter oils from the associated materials at temperatures below their normal boiling points. In this process the petroleum, after the moisture has been removed by settling or other suitable treatment, is charged into stills. Heat is slowly applied and maintained throughout the run, but the distillation is actually accomplished by steam vapors. A current of live steam is passed into the heated oil and, issuing from a multitude of fine orifices along the still bottom, carries the light oils with it and the mixed vapors pass into the condensers. These oils would require temperatures as high as 900° or 1,000° F. for actual distillation, but this steaming process removes them at a temperature as low as 600° or 650° F. Agitation due to the passage of the steam also assists by preventing any part of the asphalt from being long in contact with the bottom of the still where the heat is the greatest.

Following the path of its predecessors, it was, perhaps, to be expected that the Mexican products would encounter suspicion, doubt and opposition on entering the paving field. There had been, however, a parallel advance in the science of testing bituminous materials, and it was anticipated that this would go far toward assuring reliability. It did to a very large extent. Otherwise petroleum asphalts would not have attained their present standing. Frequently specifications were deliberately closed to these materials, but, thanks to the chemist, these conditions

have been largely eliminated, and today the best types of petroleum asphalt are welcomed in open competition with all other good materials.

THE JEFFERSON HIGHWAY.

The Jefferson Highway is an international highway planned to run from Winnipeg, Can., almost directly south through the great central farming section of the United States to New Orleans. It is about 2,500 miles long and passes through the states of Louisiana, Texas,

Oklahoma, Kansas, Missouri, Iowa and Minnesota, thence passing into Canada. A section through Arkansas has been proposed, but has not yet been officially adopted.

The Jefferson Highway Association, which is urging the construction of this road, was organized at a meeting held last November at New Orleans. At this time a tentative route was laid out and work begun in earnest. E. T. Meredith of Des Moines was elected president.

In Minnesota, the State Highway Commission took official action to designate a state highway from the Iowa line to Canada and this was adopted by the Association as the main route of the highway through Minnesota. There was more or less competition for the main route in Iowa, but the present Interstate trail from St. Paul to Kansas City was favored, as it is already in good shape and marked. For instance, there are 205 miles of gravel road between St. Paul and Des Moines on this route.

A great deal of work is going on in Missouri in the several sections. The route through this section has not as yet been finally settled, but it will probably be decided on the relative merits of the several competing roads in these sections. Oklahoma proposed to construct a strip of rock road clear across the state over the route to be followed by the highway. The section through Texas is already in good

condition, being surfaced largely with rock, with more work proposed for this summer. Louisiana is actively at work, but, like Iowa, is handicapped in securing sufficient money for road construction on account of present laws.

The association has decided that the highway shall pass through the cities named on the map; but the exact routes between these cities have not yet been selected in all cases.



ROUTE OF THE JEFFERSON HIGHWAY.



LAYING CONCRETE FOUNDATION FOR BITULITHIC BETWEEN WINNIPEG AND THE INTERNATIONAL BOUNDARY.

CORRESPONDENCE INSTRUCTION IN ROAD BUILDING.

The University of Oklahoma, through its extension division, is offering a correspondence course in road building, which consists of 24 lessons, the pamphlets for which were prepared by James I. Tucker, professor of civil engineering in that university. The course is "practical" in substance and non-technical in language. It is especially adapted to teaching road supervisors, foremen and other local road officers the details involved in constructing and maintaining earth, gravel, sand-clay and macadam roads. The cost for tuition and text-book for the course is \$11.70. Further particulars may be had by addressing the extension division of the university.

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CHANGE OF ADDRESS

Subscribers are requested to notify us of changes of address, giving both old and new addresses.

Contributions suitable for this paper either in the form of special articles or of letters discussing municipal matters, are invited and paid for. Subscribers desiring information concerning municipal matters are requested to call upon MUNICIPAL JOURNAL, which has unusual facilities for furnishing the same, and will do so gladly and without cost.

APRIL 6, 1916

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The Road Maintenance Problem.

Highway officials of twenty states have contributed to this issue exceedingly valuable opinions concerning the importance of road maintenance and methods of effecting it. The following quotations from eight of them are typical of the general opinions on the subject:

"Under a patrolman, some very common earth roads have been transformed into the smoothest riding summer roads to be found in the state, which emphasizes the importance of first taking good care of the roads we have, and then building more as fast as our funds will permit."

"It is far better (for a department) to attempt to maintain, in as good condition as possible, those travelable roads which it has under its care than to endeavor to construct

or reconstruct a relatively small mileage of the entire system."

"No community should provide for road construction without making adequate maintenance provisions; to vote a public debt for highway improvement and then neglect to maintain the road is almost a crime."

"Would it not be a good business proposition for the counties of this state, owning a property as valuable (as the improved roads), to pursue the same course that any big business concern does when it annually sets aside a fixed amount for maintenance cost, and another amount to cover cost of depreciation in values?"

"It is generally admitted that a waterbound macadam road demands maintenance work practically as soon as it is constructed."

"Many miles of good earth roads have been constructed, but practically all of this expenditure was wasted for the reason that there were no funds available for the maintenance of roads."

Unfortunately it is difficult to persuade legislatures to contribute money for maintenance. Legislation ordering a new road makes friends for the legislator from the favored district, but a once-new road which goes to pieces because of lack of maintenance makes enemies for the engineer or commissioner only, which does not bother the legislator.

The chief trouble is that the people fail to realize or to remember that no road, no matter how well built, will last indefinitely under modern traffic; and they look upon maintenance or repair operations as a reflection on the quality of the road and the man who built it.

There would seem to be considerable wisdom in the recommendations of one or two of the officials quoted above, that highway departments accustom the people to maintenance by maintaining the earth roads and other kinds already in use and demonstrating of how much benefit a few dollars so spent may be; at the same time substituting for these, as rapidly as finances will permit, improved roads of the kind which will, in each instance, give a minimum value to the sum of interest and maintenance costs.

The cost of maintaining highways (other than brick, concrete or other hard surfaces) is about 5 to 10 per cent of that of constructing them. If this amount is not spent, the maintenance problem soon solves itself—there will be no roads left to maintain. This is no figure of speech or exaggerated statement. One eastern state reports that the department originally laid out a system of main highways 250 miles in extent. Instead of heeding the advice of the department, the legislature appropriated no funds for maintenance, but instead added 465 miles of new roads to the system. The result is that the department must this year spend \$2,000,000 in entire reconstruction of 75 miles of road on which there is nothing left to repair, and repeat this for several years to come.

Unless some states quickly change their methods they will wake up some not-distant spring to find their roads the laughing stock of their neighbors and the despair of themselves.

Each mile added to the total length of improved roads in a state adds to the maintenance cost for future years. Therefore, if we assume a constant annual expenditure for roads, we must realize that year by year an increasing part of this must go for maintenance and a decreasing for construction; until at last the entire sum will be required for maintenance alone. By building roads of low maintenance cost, we may not be able to add so much mileage during the first few years, but on the other hand we are not piling up the maintenance costs for the future, and we will be able, before maintenance leaves no balance for new construction, to continue building new roads to a total mileage several times greater than would be possible if we built of high-maintenance-cost material.

The WEEK'S NEWS

State Highways in Ohio, New Jersey, Minnesota and Mississippi—New York's Fume Nuisances—St. Paul's Health Survey—The High Pressure System of Boston—The Chicago and Los Angeles and Springfield, Ill., Rate Cases—Another Week of Fires—Buffalo Firemen to Have Two Platoons—Car Strikes in Toledo and Wilkes-Barre—Three Years of New York Subway Work—Floods—The Sacramento City Plan.

ROADS AND PAVEMENTS

Big Road Contracts in Ohio.

Columbus, O.—Bids on 42 state road contracts with an estimated value of \$1,466,784, will be received April 7, state highway commissioner Clinton Cowen has announced. This is the first letting of contracts this year. It provides for the construction of more than 94 miles of roads of various kinds in 30 counties of the state. Commissioner Cowen, in a statement, says: "The fact that we are able to let so many jobs at this early date attests the sound interest in road matters in the various counties and their respective co-operation in assisting this department to secure an early start in construction work this season. It also shows what can be accomplished under the Cass highway law, new this year. We expect to let contracts at close intervals until the entire programme for 1916 is under way. With poor weather conditions last year we were able to complete 360 miles of construction. With reasonably good weather this year we hope to present to the public for travel 500 additional miles of construction and at least 1,000 miles of road repaired to a first-class condition for travel."

Pass Road Bill Over Governor's Veto.

Trenton, N. J.—The senate has re-passed five bills vetoed by Governor Fielder, including the Pierce grade crossing bill and the Egan road bill. The latter provides for road improvements to cost \$7,000,000. In vetoing the Pierce bill, Governor Fielder stated that the laws of 1913 gave ample power for the removal of grade crossings.

State road commissioner Edwin A. Stevens has notified the Board of Prison Inspectors that because of failure on the part of the legislature to grant a sufficient appropriation he will be compelled to abandon the use of convicts in public road work after April 8. Unless the legislature takes some action in the meantime this will mean the abandonment of three state road camps now giving employment of 133 convicts. The situation is regarded as unfortunate in several respects, both by the prison and road authorities. Under the state-use system now being put into effect there is not adequate opportunity at the prison to furnish employment for the men to be called in from the roads. Commissioner Stevens requested the appropriations committee to include \$75,000 in the supplemental bill and \$175,000 in the annual bill to continue the road work. The committee cut the request to \$25,000 in the supplemental and \$100,000 in the annual bills.

Road Expenditures in Minnesota.

Minneapolis, Minn.—Minnesota's expenditures in the cause of better roads this year will approximate \$7,453,451, which will go for more than 2,000 miles of grading and more than 1,000 miles of graveling highways, according to accurate figures prepared in the office of George W. Cooley, state engineer and secretary of the Minnesota highway commission. This total, the best in the state's history, adds together the state aid, the amount of the county road and bridge tax levies and the amount spent last year by the townships, which he believes is a gauge of what the townships will expend this season. The amount of the state apportionment is \$1,500,000, made up of the state roads levy and the amount received in the motor vehicle taxation. The county tax for the road and bridge funds brings in \$2,753,451, and the township figures are \$3,200,000. Of the total, about \$4,000,000 will be used under the supervision of the highway commission. Besides the amount raised

from taxation, Winona County is planning a bond issue of \$500,000 to be spent on good roads and new bridges. St. Louis County is in the van of the better highways movement, having planned \$618,000 worth of work for the year. Ramsey County will spend \$120,000 and Hennepin \$200,000 on county roads. Sixty-one of the eighty-six counties in the state have sent statements to the highway commission of the amount of work they will do. This includes a total of 1,371 miles of grading and 461 of graveling. The roads will be provided with 1,268 reinforced concrete culverts and 1,000 small culverts. Attention of county, town and village officers has been directed by C. E. Nagel, deputy engineer of the state highway commission in charge of bridges, to the section of the Dunn road law, which provides that printed notice of bids on bridges shall be mailed to the highway commission at least three weeks before the contract is let. Minnesota officials are overlooking this law and are thereby missing opportunities for saving money on contracts, according to Mr. Nagel. The intent of the statute was to have the lists in the highway commission's officers accessible to contractors, so that the range of bids would be wider. Since the highway commission, in many instances, is not receiving notice of contracts, its lists are not in great demand.

Organization of Mississippi Highway Department.

Jackson, Miss.—The senate has passed the Hewitt highway commission bill by a vote of 29 to 6. This measure previously passed the house after a narrow escape from defeat. It now goes to the governor for his signature, and it is practically certain that he will sign the bill. The measure provides for the appointment by the governor of three highway commissioners to be selected from the different supreme court districts. It also provides for a highway engineer who is to receive a salary of \$2,500 a year. The different counties building roads can demand the services of the engineer. Several amendments were offered, but all were tabled. It is hoped that the measure will result in an immense amount of benefit to the state in systematising the building of highways.

Pennsylvania and New Jersey Cooperate on Bridges.

Trenton, N. J.—The annual appropriation bill introduced in the legislature contains an allowance of \$100,000 to be used by this state with a like amount set aside by Pennsylvania toward freeing the numerous toll bridges that span the Delaware River between the two commonwealths. About five years ago the legislature of this state authorized a commission to work in conjunction with one named in Pennsylvania, the sum of \$100,000 to be given by each state annually for a period of five years, it being estimated that \$1,000,000 would be required for the purchasing of the structures owned by private interests. Pennsylvania promptly set aside its first instalment, but New Jersey repeatedly failed to do so until now. John A. Campbell, president of the New Jersey Commission, said that as soon as Governor Fielder signs the bill he will get into communication with the Pennsylvania body and arrange for a conference, when plans will be outlined for the buying up of the bridges. With \$200,000 available, several of these spans could be acquired at once. There are nearly a score of them between this city and Phillipsburg.

Camden, N. J.—Organization has been perfected in Camden by the New Jersey Bridge Commission appointed by Governor Fielder to look into the feasibility and have

plans prepared for a bridge across the Delaware between Philadelphia and Camden. In the commission's organization attorney Samuel Tilden French, of Camden, was elected president; Charles Reade Bacon, of Haddonfield, treasurer, and Dr. I. N. Griscom, of Camden, was made treasurer. It was found the commission has \$11,500 available for the preliminary work. This includes \$5,000 from Camden, \$3,500 from Burlington and \$3,000 from Gloucester county. It is also likely that there will be state aid. The commission will proceed to have surveys made of likely locations for the great structure, plans and specifications prepared and other necessary work done toward realizing the idea which has been proposed for many years past. Pennsylvania has already provided a similar commission to work in conjunction with the New Jersey body.

To Inspect All County Road Materials.

Canton, O.—Between 22 and 23 miles of brick pavement will be laid in Stark County this summer and the material on all of these roads to be improved as well as on other roads which may be improved with macadam, tarvia or gravel will be inspected at the plants or pits by chemists employed by the Pittsburgh Laboratories Company. The county commissioners have had under consideration for several months an offer of the company to give expert inspection of all materials that is shipped here for use on county roads. The contract signed provides that the county shall pay three cents a square yard for the examination of material, which will add about \$300 a mile to the cost of road improvement. Thus the cost of inspecting the material to be used on the 22.75 miles of brick road work decided on will be \$6,725. The contract provides that the commissioners may terminate the agreement at any time, if it should be decided that the inspection is costing more than it is worth to the county. The commissioners, however, say they believe that the inspection will be easily paid for in added quality of the improved roads. Highway Superintendent Sickafoose said that the county might decide later to establish a chemical laboratory for the inspection of road materials in case the plan was found to be of value.

SEWERAGE AND SANITATION

Three Sue City for Typhoid Deaths.

Milwaukee, Wis.—Three suits brought against the city of Milwaukee as a result of the recent typhoid epidemic, have been filed in circuit court, by two men for the deaths of their sons, and by a woman for the death of her husband. They are for \$10,000 each. The complainants claim that the victims contracted the disease from the use of lake water, alleged to be unfit to drink because of the sewage which is being constantly emptied into the lake. The suits charge negligence in allowing the water to become polluted and at the same time supplying it to drink. It is claimed that at various times during the last ten years the city officials have been notified of the condition of the water, but that no attention has been paid to the warnings.

New York Fights Other Fume Nuisances.

New York, N. Y.—The State of New York will bring an original action in the Supreme Court of the United States against the International Nickel Company, the Standard Oil Company of New Jersey, the Bergenport Chemical Company, and the General Chemical Company, to obtain relief from the alleged smoke and fume nuisance, which for years has been the subject of complaint of Staten Islanders living on the northwest shore, according to deputy attorney general Leonard J. Obermeier. Gov. Whitman has instructed attorney general Woodbury to begin proceedings in the highest court. On account of the comparatively narrow stretch of water that separates Staten Island from the New Jersey shore the poisonous gas-containing vapors have been the subject of complaint to the state department of health for many years. Dr. Eugene H. Porter, state commissioner of health at that time made an investigation in 1908 and 1909, and it was found that these plants on Constable Hook in Bayonne, N. J., constituted a

public nuisance. Again in 1913 an investigation was made and recently health commissioner Biggs found that these plants were a source of nuisance. Despite these complaints which have covered so many years no positive action has ever been taken up to the present time. All that the state has done has been to secure repeated promises that the nuisance would be stopped. The companies appear to have tried very hard to remedy conditions. They say they have installed every known device for eliminating the fumes, and have employed experts of various kinds to discover a means of ending the trouble. It will be shown however in the Supreme Court whether or not every precautionary measure has been taken and whether any further remedy can be applied.

Meanwhile the assembly at Albany by a vote of 85 to 21, has passed the Gilroy bill, giving the governor power to revoke the licenses of corporations within or without the state which maintain a nuisance within the state. The bill is aimed at New Jersey corporations responsible for odors which come across the Hudson River to Riverside Drive in New York City.

Health Survey of St. Paul.

St. Paul, Minn.—All the departments of St. Paul connected with health will be investigated in the health and sanitary survey to be begun this month. The survey will be made by surgeon G. B. Young, of the United States public health service, acting under orders of surgeon general Rupert Blue. Young and the necessary staff to make the survey are expected in St. Paul about April 15. The investigation will take about four weeks and will be very thorough. The report will be printed in pamphlet form together with recommendations from the investigators. Among the matters that will be investigated are: General administration and organization of health department; morbidity reports, care of contagious diseases, quarantine and detention hospitals; water supply source and control; garbage collection and disposal; street cleaning; sewerage; plumbing; food supply; milk and milk examination; social service, baby welfare; school inspection; charitable organizations; housing conditions; dwellings, apartments and homes; fly dangers; mosquitoes; outhouses.

WATER SUPPLY

City Wins Reservoir Damage Suit.

Fort Worth, Tex.—The second court of civil appeals has reversed and remanded the reservoir damage case against the city of Fort Worth, in which a jury in the sixty-seventh district court had awarded the plaintiff \$39,867.88 for damage to her land flooded by the backwaters of Lake Worth and alleged damage to adjoining uplands. This is the first of four big reservoir damage suits that have gone against the city under the present administration to be submitted to the higher court. It was appealed on the grounds that the court erred in admitting certain testimony and of misconduct of the jury in considering matter that was not in evidence. The jury awarded \$75 an acre for 361 acres of lowlands and \$9 an acre for 839 acres of uplands. City witnesses appraised the lowlands at from \$35 to \$50 an acre and testified the uplands were not damaged. By the reversal the city also saves the interest on \$39,867.88 from April 28, 1915.

Finally Gets Pumping Station Site.

Boston, Mass.—The legislature has passed and the governor has signed the bill providing for the location of the high-pressure pumping station on the banks of the Charles River Basin. Mayor Curley immediately conferred with Chairman de las Casas of the Metropolitan Park Commission, which is favorably inclined toward the proposition. The approval of the port directors and the war department must now be secured and this is practically certain. After more than three years of trouble with various sites the city has at last secured a site that will meet every demand for a station of this kind. No complete plans have been prepared for the building, but the machinery

is all contracted for at \$175,000. The building, which is to be an artistic one, it is thought, will not cost more than \$100,000. Commissioner Murphy of the public works department said that soon after all formalities had been complied with the building specifications would be ready for advertisement and that, under ordinary conditions, the plant could be made ready by fall. Between five and six miles of high-pressure pipe have been laid and the department plans to lay three more miles during the summer, the money for which will be raised by loan. This will leave only another three miles to be laid the following year for the protection of the business district.

Water Rents of Former Tenants.

Wilkes-Barre, Pa.—Water companies have no right to shut off the water supply of premises on account of the failure of the owner to pay water rent due from the former owner. This in effect is the decision of Judge Woodward handed down in the equity suit of attorney Paul J. Sherwood against the Spring Brook Water Company in which a preliminary injunction to restrain the company from shutting off a water supply of a property purchased by the plaintiff in Dorranceton is made perpetual. The opinion is far-reaching in its effect and may mean a loss of thousands of dollars each year to water companies by their inability to secure water rents owned by owners of properties who sell while in arrears with the company. The water company claimed the right to refuse water supply to any property where the former owner was in arrears unless the purchaser paid the arrearage and based their right to do so upon a rule of the company to that effect. The plaintiff in September, 1910, became the owner of the premises. There was due to the water company a water rental of \$8. The company made a demand upon Sherwood for the payment of this item and upon his refusal the company proposed to discontinue the water supply. The company held that the plaintiff was a patron of the company for at least ten years prior and was conversant with this regulation and that he had twice signed an order promising to abide by the rules and regulations of the company when he sought to get a water supply for other properties.

Water Meters in Cuba.

Habana, Cuba.—The Department of Public Works of Cuba has announced that within a short time water meters will be installed in all factories, hotels and restaurants in the city of Habana. This measure has been advocated by the secretary of public works for some time on account of the enormous waste of water in the city, but it was objected to by the sanitary department on the ground that it might give rise to uncleanness if the use of water was in any way restricted. It appears that the objections of the sanitary authorities have now been overcome and that the installation of the meters will soon be required.

STREET LIGHTING AND POWER

Company Must Open Books.

Chicago, Ill.—A victory for the city was won in the gas litigation when Circuit Judge Baldwin granted an order for the company to submit its books, papers and records to municipal experts, and to allow the city appraisers access to all physical properties of the corporation, in order to determine if the ordinance fixing rate at 75, 70 and 68 cents per thousand cubic feet during five years is legal. The legality of the ordinance depends on its "reasonableness." This can be determined only by a valuation of the company's property and a calculation of what dividends it should earn. The corporation claims its properties are worth \$70,000,000. The city has fixed a valuation of approximately \$51,000,000. Judge Gibbons, on the petition of the gas company, for an injunction to restrain the city from enforcing the ordinance, fixed the rate at 80 cents, pending the outcome of the present litigation. One phase of the case is now in the Supreme Court on a mandamus to

vacate certain orders granted the city, but the decision of that court will not conflict with Judge Baldwin's ruling. The litigation was caused by the enactment on July 17, 1911, of an ordinance to fix gas rates for the ensuing five years at 75 cents for the first year, 70 cents for the second year and 68 cents for the remainder of the term. The proof of the allegations by the company cannot be easily or readily made by the city, the court said. Reference is made in the decision to the appearance of Samuel Insull, chairman of the board of directors of the gas company, before the meeting of the gas rate litigation committee of the council on January 12. Mr. Insull stated that a valuation of the property would be necessary to determine the cost of producing and distributing gas and that such an investigation would cost approximately \$200,000 or \$300,000. It was also stated at that meeting that an investigation was being made of the gas company by the state public utilities commission and Mr. Insull's principal objection to the city's participation in the investigation was that it would amount to a duplication of expenditures on the part of the utilities commission and the city. The court held that while there is much force in the suggestion that duplication and waste in this matter could be avoided, he is aware that there is pending before Judge Taylor of the Circuit Court the proceedings by which the legality of the commission's existence is being tested, and that it cannot be now said that there will be any utilities commission in existence after a final determination of the litigation. The decision also says that the gas company voluntarily invoked the jurisdiction of this court; it filed its petition, making many allegations of fact as a basis for its claim that the ordinance was unjust and unreasonable; it procured an injunction against the city, prohibiting the enforcement of the ordinance, and it has, during more than four and one-half years since the injunction was issued, continued to sell its gas at a rate barely deducible from its own petition as being, in its judgment, a reasonable one; and all this without a bond, such as is usually required in the case of an injunction.

Company Need Not Install Meters.

Roseville, Cal.—The Railroad Commission at San Francisco has dismissed the complaint of the city of Roseville, Placer county, against the Pacific Gas and Electric Company, wherein the city asked the Commission to compel the company to install meters. The Commission found that the city of Roseville's interest was not such as to justify the complaint.

Los Angeles Gas Case Opens.

Los Angeles, Cal.—Commissioner E. O. Edgerton, sitting for the state railroad commission, has opened the hearing of the applications of the city of Los Angeles and the gas companies for the fixing of a rate on gas. Upon the outcome of this hearing will depend whether the commission will order the companies to distribute straight natural gas at natural gas prices. Mr. Edgerton announced that the procedure would be to hear the application of the Los Angeles Gas and Electric Company first, together with so much of the case of the city of Los Angeles and this company and the Southern California Gas Company as applies to the rates of those companies. Richard Sachse, chief engineer for the railroad commission, testified that experts under his direction had made an investigation of the properties, including valuations, inventories, physical properties and estimates of costs, to determine the reproduction costs new and reproduction costs less depreciation. The reproduction cost new of the gas properties of the Los Angeles Gas and Electric corporation, he said, had been found to be \$11,274,874 for property inside the city of Los Angeles, and \$2,507,779 for property outside the city, making a total of \$13,782,653. Reproduction cost less depreciation for property inside the city was figured at \$8,760,750 and for outside the city at \$1,985,934, or a total of \$10,746,685. Mr. Sachse stated that the auditor's report showed the original cost of the property, exclusive of real estate, franchises, etc., as \$10,312,732 and that his own estimate of the cost of the property entire was between \$12,-

000,000 and \$13,000,000. Mr. Goudge of the Los Angeles Gas and Electric corporation subjected Mr. Sachse to a searching cross-examination and drew forth an admission that this estimate of the cost was not based upon the actual prices for material today, but in some instances upon the average prices. Mr. Sachse explained, however, that where average prices were used it was in such cases as steel and copper, the market value of which is constantly fluctuating. Prof. C. L. Cory of the state university, testified to valuations of the property of the Los Angeles Gas and Electric corporation made by him, the last one being October 1, 1915. This report showed the actual original cost of the gas property, both inside and outside the city, to be \$14,439,292, and the reproduction cost at the price of labor and materials on that date \$15,703,683. These figures, exclusive of the overhead charges, correspond closely to the estimate made by the commission's engineers. Including the overhead, however, there is a difference of nearly 5 per cent. between the two reports, that of the commission being that much lower on this one item. The position of the city in this hearing will be that the people of Los Angeles be given the benefit of the enormous supply of natural gas available, and that the price be reduced in conformity with the lower cost of production of the natural product as compared with manufactured gas, upon which the prices of gas in this city have been based in the past. The board of public utilities will insist on the principle of the largest use of natural gas so that the people may obtain the benefit of the pure product at natural gas prices. The board will also introduce testimony asking for an industrial rate for the benefit of local manufacturers to use up any excess gas that can be transported to Los Angeles, because the earnings from the sale of industrial gas will be reflected in the domestic rate. At present the companies are charging 68 cents per 1,000 cubic feet, except the Economic Gas Company, which is charging the ordinance rate of 64 cents and is distributing straight natural gas from the Sherman oil field.

City Wins Cheaper Gas.

Springfield, Ill.—The Illinois public utilities commission, in a new decision, has cut the gas rate charged by the Springfield Gas and Electric Company from \$1 net per 1,000 cubic feet to 80 cents net. The reduction will amount to a saving of \$50,000 annually to the gas-consuming public of the city. Hearings on the Springfield case have lasted over two years. More than 4,000 pages of testimony was taken and exhaustive investigations were conducted by the commission's experts. The fight for lower gas rates for Springfield was led by Willis J. Spaulding, commissioner of public property. The commission's order is effective April 9. The decision is expected to be the forerunner of others affecting other cities in the state.

FIRE AND POLICE

Another Cotton Fire.

Houston, Tex.—Houston's existence was seriously threatened when a large cotton warehouse, filled to the roof with cotton, caught fire, while a strong gale was blowing. Although the damage amounted to more than \$500,000, the citizens of Houston congratulated themselves on the efficiency of their fire department. The fire occurred in the very heart of the city, and it was confined to that particular area. For nearly two hours great blazing embers were carried long distances by the wind and deposited on wooden roofs which were dry, but by strategical distribution of its forces in the threatened district, the fire department officials were able to extinguish all incipient blazes. The fire originated among some trash on a railroad repair track and the wind swept some of the burning shavings into the cotton warehouse. The warehouse was nearly two blocks long, and cotton was tiered nearly to the ceiling, and it was burning from top to bottom and from end to end when the first section of the fire department arrived. A general alarm was turned in and all the reserve fire companies were ordered out. Fire Chief Fred Seibert carefully laid his plans for a hard afternoon's work. Water Commissioner Fitzgerald cut off water service to the south

half of the city and directed all the city's water supply into the mains leading toward the fire. It was several days before the fire in the cotton was quite extinguished.

Dynamite Stops Fire Spread.

Leadville, Colo.—Dynamite was used to prevent the spread of a fire which threatened to destroy the business district. Ten buildings were destroyed, with an estimated loss of \$100,000. There were no casualties.

Big Chemical Plant Blaze.

Copper Hill, Tenn.—More than \$1,000,000, it is estimated, was the loss in the fire which totally destroyed the two main buildings, acid tanks, crude and finished products of the Carcolite Chemical Company here. By the explosion of one of the large chemical tanks, the assistant-superintendent was fatally injured. The fire originated from acid boiling over in one of the kettles. The plant for the last few months has been employed in the manufacture of ingredients for high explosives.

Town Practically Destroyed.

Lexington, S. C.—Practically the whole town of Lexington was destroyed by a fire, which started late at night, doing an estimated damage of \$125,000, and wiping out almost every business house in town. The court house and the county jail were saved by heroic efforts. The fire originated in a drug store, and was quickly swept by a northwest wind to adjoining buildings on each side. The Columbia fire department was called upon for aid and responded promptly, but on account of lack of water supply the firemen were powerless to lend assistance.

Fire Sweeps Village Business Street.

Oxford, N. Y.—Fire of unknown origin broke out in the National Protective Legion Hall here eight miles south of Norwich. The flames spread rapidly and in less than an hour five wooden buildings, constituting the entire Main street business block of the village, were destroyed at a loss estimated at \$100,000. Among the buildings were the gas and electric companies' office, the postoffice and many stores. The Norwich Fire Department was called out, but owing to a delay by blocked traffic of railroad, it did not reach Oxford until the fire had nearly worked itself out.

Fire in Railroad Yards.

New Haven, Conn.—Three large shops and several smaller buildings at the yards of the New York, New Haven & Hartford Railroad were destroyed by a late night fire, causing an estimated loss of \$700,000. The fire started in a building where iron was stored, spread to the paint house, where hundreds of barrels of varnish and paints caught fire, and then jumped to the signal equipment storehouse, the boiler shop, tank shop and the storehouse office. The firemen were handicapped by low water pressure, and it was not until after midnight when the fire was controlled. For nearly an hour there was a steady series of explosions of track torpedoes, which were stored in one building.

Fire Threatens Skyscrapers.

New York, N. Y.—A fire which raged for three hours in large stocks of paper in two old five-story buildings surrounded by numerous skyscrapers for a time threatened one of New York's congested business districts. One building of fourteen stories and another of twenty, the walls of which ran along the side of the burning buildings, were damaged by heat and water and the occupants of the offices were ordered out. Windows were melted out in the buildings, one 200 feet away, by the currents of heated air. The structures and stock burned had been left from a fire of March 13. The newspaper offices of the Evening Sun were threatened and filled with smoke. Chief Kenlon responded to the four alarms, and soon nearly a score of streams were at work from a water tower, from the upper floors of adjoining buildings and from the street. No movable engines were used, pressure coming from the high pressure system. The firemen were much hampered by the narrow streets and the congestion. Immediately in front of the burning buildings is the new subway excavation, and this filled with smoke and the tracks were covered with water. The fire's cause is unknown and damage was about \$30,000.

Burning Power Plant Cuts Water Supply.

Superior, Neb.—Fanned by a heavy gale, flaming fire brands were swept toward the heart of the city and Superior was threatened with destruction by fire for several hours, when flames broke out in a milling plant. The mill, as well as the light and power plant, of the Southern Nebraska Power Company, and many frame residences and outbuildings, went before the fire was under control. The water supply of the city was in a large measure dependent upon the burning electric power plant, and, when that failed, the situation became serious, but by carefully husbanding the supply on hand Mayor W. S. Young and Chief George Johnson were able to get the fire under control after it had burned for some two hours. As a result of the destruction of the power plant, Superior industries are at a standstill, and its residents without lights.

Two Platoons for Buffalo Firemen.

Buffalo, N. Y.—By a vote of four to one, the council has approved the petition of the firemen for a two-platoon system. A report recommends that the system go into effect on July 1, the beginning of the next fiscal year. It is estimated that the cost of the new system will be \$221,000 for the first year and \$289,000 at the end of the fifth year, the difference being caused by the annual increases in salary of the 230 men who will have to be added to the department. Firemen now are on duty 21 out of 24 hours a day. Under the proposed system they will work 10 hours days and 14 hours nights. They will not get the days off each month which they now have.

Firemen Refuse to Be Street Cleaners.

Niagara Falls, N. Y.—Firemen Joseph McMahon, Fred Roll and Norman Robido were suspended for refusing to obey City Manager Carr's order to join the bureau of public service force in cleaning Falls street. They persisted under penalty of dismissal. The men were charged with insubordination. The Niagara Falls Board of Fire Underwriters and the Niagara Falls branch of the State Civil Service Employees' Association took up the matter on the questions of civil service rules and the efficiency of the fire department.

Pittsburgh to Have River Police.

Pittsburgh, Pa.—Pittsburgh's police will soon begin a patrol of the rivers in the manufacturing district, to check the thieving that has been carried on along the waterfront for years. Police Commissioner Robert J. Alderdice decided on this course after going over the reports of goods recovered by the police that had been stolen from plants along the river banks. Said the commissioner: "River pirates in and around Pittsburgh are annually getting away with loot from the manufacturing plants and other corporations located along the river banks to the amount of between \$75,000 and \$100,000. The only way to stop them is for the city to adopt a system for patrolling the rivers, as the recent history of these depredations proves that the police are unable to control the actions of the pirates, who work at nights and successfully get away with their loot." The program mapped out by the police is to man at least two fast motor boats for patrol service, to be in use day and night.

STREET CLEANING AND REFUSE DISPOSAL

New Garbage Contracts.

Pueblo, Colo.—The city is now being paid for having its garbage hauled away. By a contract signed with the city commissioners, Sam Olson agrees to pay \$502 a year, but trouble has arisen in enforcing it, which promises to develop into a lively legal battle. Olson agreed to collect the garbage in the business district once a day and in the residence districts at least twice a week. The contract gave him the exclusive right to collect it from all persons and provided a fine not only for anyone attempting to collect garbage, excepting Olson, but also a penalty for those who permitted other parties to obtain their refuse. According to the hotel and restaurant proprietors, they have been receiving compensation for their

garbage, which collectively, they say, is far in excess of the sum to be paid the city. They take the position that the garbage is their property and that, if they can sell it to advantage to themselves, it does not concern the city, so long as the removal and disposition of the slop are handled in a sanitary manner and according to the health department requirements. The health department takes the position that the only way in which the proper results can be obtained is by controlling the entire garbage disposal system. Accordingly, ten hotel men signed a contract with Joe Putka, a hog raiser, under the terms of which they are to receive compensation for their garbage. Putka started out on his rounds and was arrested. By agreement of counsel a minimum fine was imposed upon Putka with the understanding that an immediate appeal would be taken and that, pending a decision in the higher courts, Putka would not be molested again.

Stop Paper Collections.

Harrisburg, Pa.—An order has been issued to the Pennsylvania Reduction Company, by the City Health Bureau, that the collection of loose paper, boxes, barrels and cartons from business places will be discontinued. The bureau says that the reduction company is back in its regular collection of ashes and that the delay is due entirely to the collection of this rubbish from stores and other places of business. The collection of this rubbish is not mentioned in the contract the bureau made with the reduction company.

Cleveland's Garbage Profitable.

Cleveland, O.—The city's garbage reduction plant is proving a profitable property. Elated over the returns from the sale of garbage grease, \$52,000 higher the last six months, city officials announce that experiments are being made with a view to increasing receipts by turning out of new by-products. If one experiment proves successful, Cleveland will be the owner of a municipal soap making plant. Public Service Director Alex Bernstein also announces plans are being made for turning out an improved type of fertilizer.

May Sprinkle Streets Without Contract.

Syracuse, N. Y.—Governor Charles S. Whitman at Albany has signed the Syracuse street sprinkling bill, which immediately becomes effective. The new law gives the city the option, on authorization of the common council, to sprinkle streets without contract, assessing the cost as a local improvement. Unless contractors offer fair terms, it is thought the city will do the work, but it is believed proposals will be advertised for as in former years by the city administration. The Syracuse paving bill has already been passed in the Assembly and probably will be approved in the Senate. It radically changes the present system of payment for paving maintenance. The city at large now pays for repairing 37½ per cent of the area and then pays one-third of the cost of resurfacing. The bill places all maintenance cost on the city, relieving the property owners entirely after they have paid the first cost.

RAPID TRANSIT

Toledo Car System Tied Up.

Toledo, O.—Following attempts of the Toledo Railways & Light Company officials to prevent the car men from forming a union and wearing the union button, the men went out on strike, completely paralyzing the whole transportation system of the city. Jitneys are of course reaping huge profits. The men are well organized, and the company is firm, so that the attempts at a settlement by Mayor Milroy and the city officials have proved unsuccessful. Henry L. Doherty, president of the parent company, was called from New York by President Coates to enter into the conferences between the mayor, business agent John Quinlivan, of the Central Labor Union, and Edward McMorow, of the Amalgamated Association of Electric and Street Railway Employees of America. Following the advice of the mayor and the threat of the electrical workers to shut off all lighting in the city if strikebreakers were

imported, the company decided not to attempt to operate the cars. City law director Harry S. Commager has prepared a bill and filed it in the federal court, asking the appointment of a receiver for the company in the event of an ultimate disagreement. A committee appointed on the question of a street car franchise reported to the mayor a new plan—"community ownership," by the company separating its car properties, reorganizing and selling stock in small shares to citizens—and ultimately arranging for the city to take over all this stock. The company owns 116 miles of road and about 300 cars.

Rioting in New Wilkes-Barre Strike.

Wilkes-Barre, Pa.—Cars have been stoned and strike-breakers attacked by carmen in a new strike in this territory of the Wilkes-Barre Railway Company. Sheriff Bush and the state police troopers are at work and a "law and order league" has been formed by citizens. Several lines have discontinued service.

Jitneys Not Public Utilities.

Springfield, Ill.—Jitney busses are not public utilities, as operated in Hillsboro, Ill., according to a decision of the public utilities commission. Operators of bus lines here say the decision will be considered a victory for jitney men all over the state.

Three Years' Work on New Subways.

New York, N. Y.—March 19 was the third anniversary of the signing of the "dual system" rapid transit contracts by the Public Service Commission for the First District. In the three years that have elapsed the commission has awarded construction and finish contracts aggregating \$110,660,021.20. Before the contracts were signed it had awarded contracts in the amount of \$60,340,789.85, so that the total amount of contracts outstanding February 1, 1916, was \$171,000,811.05. The Commission also in the last three years has awarded miscellaneous contracts for rails, ties and other materials aggregating \$4,661,714.27, so that the grand total of city contracts is \$175,662,525.32. The city, however, is not pledged for the entire amount, as there is included in it a certain percentage of the contributions made by the two companies towards the cost of construction, namely, \$58,000,000 by the Interborough Rapid Transit Company and about \$14,000,000 by the New York Municipal Railway Corporation. Under the dual system certificates for the third-track and extension of the elevated railroads both companies have awarded construction and equipment contracts aggregating fully \$40,000,000. The total amount of construction contracts already awarded on the dual system aggregate, therefore, about \$215,000,000. The construction work is divided into 89 contract sections. Of these 75 have been placed under contract, and plans for the remaining 14 are nearly completed. Bids for several of these will be invited within the next six weeks, and before the end of the year it is expected that all contracts will have been awarded.

MISCELLANEOUS

More Floods.

Buffalo, N. Y.—About 20 miles of streets were submerged and ice jams threatened the bridges along the Buffalo river in the worst flood here in 35 years. At Batavia the Niagara Power Company and municipal plants were put out of commission by the high waters of the Tonawanda creek, leaving the city in darkness. At Jamestown the Levant pumping station was threatened, and ice jams at the bridge had to be dynamited. Quickly rising, the Allegheny river at Olean threatened to flood the industrial section of the city and succeeded in breaking a main of the Producers' Gas Company, leaving part of the city without gas. The flood also will seriously affect the plans of the preliminary survey for flood abatement work. At Mount Morris trolley and railroad tracks were washed away.

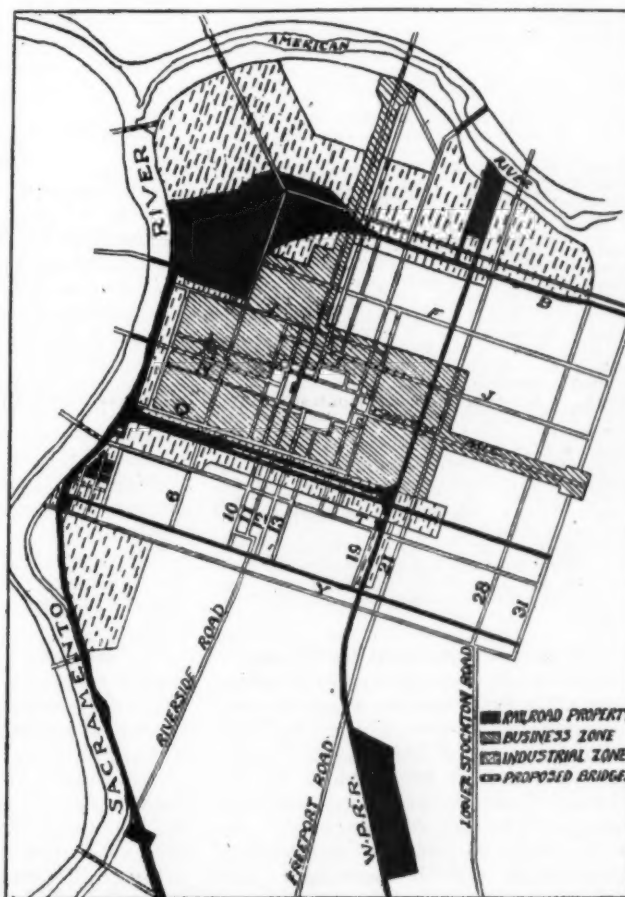
Pittsburgh, Pa.—This city, Warren and Franklin, and many others were threatened by rapid rises in the river, but the danger seems now to be passed.

Columbus, O.—The west side residents of the city were driven out of the houses by the threatening flood and the state militia was held in readiness for relief work. The Scioto, Blanchard, Olentangy, Mahoning, Miami, Sandusky, Ohio and Muskingum rivers rising caused serious flood conditions in many cities in the state, including Youngstown, Newark, Zanesville, Conneaut, Tiffin, Napoleon, Kenton and Findlay.

Flint, Mich.—In the worst flood in twelve years about a hundred families were rendered homeless and much property loss sustained. City engineer Shoecraft had a force at work strengthening the cofferdam. Saginaw, Lapeer, Detroit and Bay City also suffered.

Planning Sacramento.

Sacramento, Cal.—In the adoption of the preliminary city plan, as outlined by city planner John Nolen, the city commission has decided upon a definite policy with regard to the location of its business and manufacturing districts. The adoption of the Nolen plan means that henceforth no business or manufacturing plant may locate in any district but that set aside for it. Variation from this plan may be provided for in Nolen's final plan, which will be presented to the commission shortly for adoption. It is not thought likely, however, the final plan will vary greatly from the preliminary plan. Nolen's idea of locating the industrial zone, or manufacturing center, in the district chosen was because of the natural facilities afforded there. The proximity of the Sacramento River and the possibility of some day establishing a dock-center at the point where the American empties into the Sacramento, was one of the main factors in leading Nolen to select this as the main manufacturing center. The accompanying plan shows the districting scheme.



JOHN NOLEN'S DISTRICTING OF SACRAMENTO.

NEWS OF THE SOCIETIES

Calendar of Meetings.

April 8.—AMERICAN WATER WORKS ASSOCIATION (Four-State Section), Atlantic City, N. J.

April 10-22.—NATIONAL CONFERENCE ON COMMUNITY CENTERS AND RELATED PROBLEMS. First conference, New York City. Secretary, John Collier, 70 Fifth Ave., New York.

April 11-14.—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting, Hotel Grunewald, New Orleans, La. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

April 18-21.—AMERICAN CHEMICAL SOCIETY. Meeting, University of Illinois, Urbana, Ill.

May 2, 3.—PENNSYLVANIA STATE CHIEFS OF POLICE. Annual convention, Park Hotel, Williamsport, Pa. Secretary, George W. Harder, Williamsport, Pa.

May 8-10.—SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, Waco, Tex. Secretary, E. L. Fulkerson, Waco, Tex.

May 10-17.—NATIONAL CONFERENCE OF CHARITIES AND CORRECTIONS. Annual conference, Indianapolis, Ind.

May 31-June 2.—NEW YORK STATE CONFERENCE OF MAYORS. Annual conference, Syracuse, N. Y.

May 31-June 2.—NATIONAL ASSOCIATION OF COMPTROLLERS AND ACCOUNTING OFFICERS. Annual convention, Syracuse, N. Y.

June 4-8.—AMERICAN WATER WORKS ASSOCIATION. Thirty-sixth annual convention, New York, N. Y. Secretary, J. M. Diven, 47 State Street, Troy, N. Y.

June 5-9.—AMERICAN WATER WORKS ASSOCIATION. Thirty-sixth annual convention, Hotel Astor, New York City. Secretary, J. M. Diven, 47 State street, Troy, N. Y.

June 15, 16.—OHIO SOCIETY OF MECHANICAL, STEAM AND ELECTRICAL ENGINEERS. Convention, Cleveland, O. President, Joseph L. Skeldon, Toledo.

June 28-30.—MICHIGAN LEAGUE OF MUNICIPALITIES. Annual meeting, Battle Creek, Mich.

July 11-13.—MUNICIPAL LEAGUE OF INDIANA. Annual meeting, Goshen, Ind.

July 25-27.—CENTRAL NEW YORK VOLUNTEER FIREMEN'S ASSOCIATION. Annual convention, Seneca Falls, N. Y. Secretary, Stewart W. Smythe, Cortland, N. Y.

Aug. 7-9.—CITY MARSHALS' AND POLICE CHIEFS' UNION OF TEXAS. Annual convention, Houston, Tex.

Aug. 8-11.—DOMINION ASSOCIATION OF FIRE CHIEFS. Annual convention, Windsor, Ont. Secretary, James Armstrong, Kingston, Ont.

Aug. 21-27.—PACIFIC COAST ASSOCIATION OF FIRE CHIEFS. Annual convention, San Diego, Cal.

Aug. 29-Sept. 1.—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual convention, Providence, R. I. Secretary, James McFall, Roanoke, Va.

Sept. 6-9.—LEAGUE OF AMERICAN MUNICIPALITIES. Annual convention, Newark, N. J.

Oct. 9-13.—AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Twenty-third Annual Convention, Robert Treat Hotel, Newark, N. J. Secretary, Charles Carroll Brown, 702 Wulsin Building, Indianapolis, Ind.

Oct. 16-21.—NATIONAL SAFETY COUNCIL. Fifth Annual Safety Congress, Detroit, Mich. Secretary, W. H. Cameron, Continental and Commercial Bank, Chicago, Ill.

Engineering Conference in Chicago

Engineering organizations are invited to send delegates to a conference of engineering co-operation to be held on Thursday and Friday, April 13 and 14, at room 1735 Monadnock Block, Chicago. The following items, among others, may be considered:

1. Co-operation among engineering organizations. Is it desirable? In what way is it practicable?

2. Benefits of co-operation in secur-

ing greater efficiency in the larger matters of concerns to the individual engineer, to the profession, and to the public.

3. Methods of co-operation now in practice in various localities; results attained in Philadelphia, St. Louis, St. Paul and other places.

4. Various kinds of engineering societies and committees and the relative efficiency of their operations.

5. Relation of the specialized or exclusive national engineering societies to their local sections or branches and to the more inclusive local engineering society or club.

6. Result of co-operation in securing wider diffusion of knowledge on engineering subjects, as illustrated at Cleveland and elsewhere.

7. The engineering profession as a whole in its present condition as regards public esteem.

8. Reasons for decline in attendance at engineering colleges. Is it indicative of healthful conditions or of proper methods of education?

9. Employment; methods and results as practiced by various engineering societies; an exchange of ideas.

10. Legislative activity, proper limits to be set, dangers to be avoided and needs of more systematic and better directed efforts.

The meeting has been called by the Committee on Engineering Co-operation, Dr. F. H. Newell, University of Illinois, Urbana, Ill., chairman, and C. E. Drayer, secretary Cleveland Engineering Society, secretary.

American Society of Mechanical Engineers.

The papers to be read at the spring meeting of the American Society of Mechanical Engineers, to be held in New Orleans, April 11 to 14 inclusive, embrace the following:

"Organizing for Industrial Preparedness," by Spencer Miller, Lidgerwood Mfg. Company, New York City, and member of the Naval Consulting Board.

"Evolution of Low-Lift Pumping Plants in the Gulf State Country," by William B. Gregory, professor of experimental engineering, Tulane University, New Orleans.

"Mechanical Equipment Used in the Port of New Orleans," by William von Phul, Ford, Bacon & Davis, New Orleans.

"Establishing a Standard of Measurement for Natural Gas in Large Quantities," by Francis P. Fisher, assistant general manager of the Wichita Natural Gas Company, Bartlesville, Okla.

"Deviation of Natural Gas from Boyle's Law," by Robert F. Earhart and Samuel S. Wyer, consulting engineer, Columbus, Ohio.

"Some Experiments on Water-Flow through Pipe Orifice," by Horace Judd, associate professor of experimental en-

gineering, Ohio State University, Columbus.

"Measurement of Viscosity and a New Form of Viscosimeter," by H. C. Hayes and G. W. Lewis.

"On the Transmission of Heat in Boilers," by E. B. Hedrick and E. A. Fessenden, associate professor of mechanical engineering, University of Missouri, Columbia, Mo.

Southwestern Waterworks Association.

The fifth annual meeting of the Southwestern Waterworks Association will be held at Waco, Texas, May 8, 9 and 10. It is composed of seven states, Texas, Arkansas, Louisiana, Oklahoma, New Mexico, Kansas and Missouri. Jesse Shaw of Topeka, Kan., is president of the association and E. L. Fulkerson of Waco is secretary treasurer. The following program has been prepared for the convention:

Monday, May 8—Invocation, the Rev. Father Heckman, Temple, Texas; opening address, John Dollins, Mayor, Waco; response to address of welcome, R. W. Finley, Austin; "The History of the Water Plant at Waco, Under a Water Commission," Judge W. M. Sleeper.

Tuesday, May 9—"The Functions of a Water Company, or City Water Department," Jesse Shaw, superintendent water company at Topeka, Kan.; "Efficient Lubrication and How to Prevent Losses," Harry H. Howard, Dallas; "Accounting and Auditing as Affecting the Successful Management of a Waterworks System," Horace Pickett, Waco; "Efficiency in the Installation and Care of Water Meters," Dwight P. Childs, Matton, Ill.; "The Trend of Modern Water Purification Methods," C. Arthur Brown, Chicago, Ill.; "Use of High-Grade Material and Creation of New Business," C. H. Du Bois, San Antonio.

Wednesday, May 9—"The Drilling of a Trinity Sand Well," Ernest L. Meyers, hydraulic engineer, Dallas; "Efficient Firing of Boilers and How to Obtain Best Results," H. H. Howard, Dallas; questions and resolutions; election of officers, 1916-17; selection 1917 convention city; unfinished business.

William Penn Highway Associations.

Six hundred and fifty good roads advocates from the fourteen counties to be traversed by the proposed William Penn highway from Philadelphia to Pittsburg via Reading, Harrisburg and the Juniata Valley, met at Harrisburg, March 27, at the call of Governor Brumbaugh and organized a permanent association to work for the early completion of the project.

Resolutions were passed making the William Penn highway a part of the Pikes Peak ocean-to-ocean highway, and a board of governors was elected, one from each county, along the route.

William Jennings, Harrisburg, representing Dauphin County, was elected president; E. M. C. Africa, Huntingdon, first vice-president; Frank M. Graeff, Blairsville, second vice-presi-

dent; David Barry, Johnstown, treasurer, and E. E. Gibbs, Huntingdon, temporary secretary. A permanent secretary will be elected by the governors.

The board of governors as elected is made up of Dr. Joseph D. Findley, Altoona; W. L. Plack, Philadelphia; H. M. Minker, Reading; A. A. Weimer, Lebanon; William Jennings, Dauphin; G. H. Rittman, Millerstown; William H. Manbeck, Mifflin; James Macklin, McVeytown; E. M. C. Africa, Huntingdon; David Barry, Johnstown; Frank M. Graeff, Blairsville; S. H. Jackson, Murrayville, and H. Y. Donahy, Allegheny County.

Upper Peninsula League of Municipalities.

At a meeting held at Escanaba, Mich., March 22, the organization of the Upper Peninsula League of Municipalities was completed and the following officers elected: Sherman T. Handy, Soo, president; M. B. Lloyd, Menominee, first vice-president; Mayor McMillan, Escanaba, second vice-president; Mayor Hartman, Houghton, third vice-president; W. G. Monroe, Iron Mountain, secretary and treasurer; directors: Mayor Begole, Marquette; Mayor Hegatton, Negaunee; Mayor Cruse, Iron Mountain; Mayor Driscoll, Ironwood; Mayor Munno, Crystal Falls; executive committee: Mayors Handy, Begole and Cruse.

Utah-Idaho-Yellowstone Highway Association.

At the meeting of the association held at Salt Lake City, March 23, officers were elected as follows:

Mark Austin, of Rexburg, president; C. C. Deitrick, of Idaho Falls, secretary-treasurer, and vice-presidents, one from each county, as follows: Theo. Turner, Bannock county; Sam Swanson, Teton county; Otto E. McCutchin, Bonneville county; S. S. McCann, Franklin county; N. Ricks, Madison county; W. E. Petrie, Bingham county; S. Fortes, Power county; Tim Covert, Oneida county; N. D. Jackson, Fremont county, all in Idaho, and Leroy Young, Box Elder county; William Peterson, Cache county; O. B. Gilson, Weber county; David E. Cook, Rich county; David Cook, Davis county, and W. D. Rishel, Salt Lake county, all of Utah. Executive committee, P. G. Johnson, of Blackfoot, Ida.; N. D. Jackson, St. Anthony, Ida.; George Blood, Preston, Ida.; M. D. Evans, Malad, Ida., and B. F. Redman, Salt Lake.

Ohio Good Roads Federation.

A test of sentiment is being taken by the Ohio Good Roads Federation on a proposal to amend the constitution of the state through the initiative to commit the state to a settled policy of road construction and repair that will meet the public demand. The proposal has underlying it two principal ideas, the first of which is to place the road work of the state upon a plane that it cannot be disturbed through change

of administration or by reason of the whims of majorities in the general assembly. The second idea is that the funds of the state for highway work should be made sufficient to meet the urgent demands of the people.

In the past two months requests have been filed with the state highway commissioner for upwards of \$4,000,000 of state funds to which was added twice as great sums from local communities. The fund for disposal by the state has been less than \$500,000, which is wholly inadequate. The clamors for funds have been repeated to the federation and are largely responsible for the decision for an informal referendum to civic, agricultural and commercial organizations. If the result of this canvass of sentiment is favorable, the matter will be submitted to the voters next November.

In general, the proposal outlined is that of the labor men in the constitutional convention of 1912 as a substitute for the bond proposal. The suggested proposal is for an annual levy

(Continued on page 498.)

PERSONALS

Carter, F. M., has resigned as city engineer of Ellensburg, Wash.

Crittenden, Ernest, has been appointed chief of police of Hazleton, Pa.

Coulson, Solomon, aged 67, former superintendent of the Pittsburgh Bureau of Police, March 20, died in his home, 5129 Liberty avenue. He had spent 29 years in the service of the city. For the past year his health had been failing, but only recently did his condition become serious. Mr. Coulson first joined the police bureau as a roundsman.

Gammon, Melville, first commissioner of Rome, Ga., died March 9, at his home. He was 75 years old.

Girardot, August, has succeeded Louis Vanderly as road superintendent of Jackson Township, Indiana.

McCullough, Ernest, for many years a well-known consulting engineer who has specialized largely on reinforced concrete design and construction, has recently become identified with the Portland Cement Association, 111 West Washington street, Chicago. Mr. McCullough will be known officially in his new connection as chief engineer, Fireproof Construction Bureau. Mr. McCullough received his engineering training in California, where he was graduated in 1887 as a civil engineer. He has served in many engineering capacities and has been well known as a writer for many years, having been connected in an editorial capacity with Engineering and Contracting and the Railway Age Gazette. In addition, Mr. McCullough is the author of several well-known books, among them being "Practical Surveying," "Engineering as a Vocation," "Engineering Work in Towns and Cities," and "Practical Structural Design." Mr. McCullough is a member of the American Society

of Civil Engineers, the Chicago Engineers Club and the Western Society of Engineers, having served the last as second vice-president in 1914, first vice-president in 1915, trustee in 1911, 1912, and 1913, and at present as trustee of the society for a three-year term ending 1918.

Seifert, Herman, chief of the Garfield, N. J., fire department, has resigned.

Stevens, Frederick C., superintendent of public works of New York under Governor Hughes and a former state senator, died at Attica, N. Y., March 15.

Woodbury, Charles Jephtha Hill, one of the best known engineers in the country, and with a wide reputation as a historian, an art connoisseur, and a lecturer, died March 20 at his home, 51 Baltimore street, Lynn.

Youngman, B. E., has been re-elected city engineer of Hazleton, Pa.

The following have been elected in Maine:

Ripley—Selectmen, C. W. Wakefield, J. G. Jewett, E. R. Felker; town clerk, P. T. Additon; treasurer, C. S. Downing.

Jackson—Selectmen, R. M. Stiles, R. E. Page, Carlton Ricker; town clerk and treasurer, W. E. Warren.

Montville—Selectmen, W. S. Me-huren, Geo. C. Carter, E. B. Bean; town clerk, M. M. Wentworth; treasurer, C. B. Cushman.

Leeds—Selectmen, F. H. Herrick, Leeds; E. E. Additon, Greene; E. A. Russell; town clerk, D. F. R. Russell.

Isle Au Haut—Selectmen, W. B. Coombs, Guy E. Barter, Elmer Thomas; town clerk, J. K. Collins; town agent, selectmen; treasurer, W. S. Rich.

East Millinocket—Selectmen, Jas. H. Mack, F. O. Pray, R. Dickinson; town clerk, J. A. Flye; treasurer, W. A. Johnston.

Bluehill—Selectmen, Austin T. Stevens, Harvey McIntyre, Fred S. Hinckley; town clerk, Walter E. Stover; treasurer, I. E. Stanley.

Following officers have been elected:

Belington, W. Va.—Mayor, W. B. Huffman; recorder, J. W. Dadisman; councilmen, G. H. Proffitt, J. D. Thacker, I. J. Keiser, J. N. Hoffman and L. M. Jackson.

Post City, Tex.—Post City was incorporated under commission form of government with W. L. Davis, mayor; W. H. Clark and C. I. Dickinson, commissioners.

Vale, Ore.—Leonard Cole, mayor; J. L. Lynd and J. M. Randolph, councilmen; Leslie L. Hope, treasurer and J. R. Wheeler.

Georgetown, Del.—John R. Steele, mayor; Wilbur Tunnell, Andrew Marvel, Albert Polk, John Hammond and Walter Roach, councilmen; Roland Messick, treasurer; Cyrus Hatfield, collector; Minos Short and George Short, auditors, and William Hobbs, assessor.

NEW APPLIANCES

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations.

A NEW PAVER.

High Drum Smith-Chicago Mixer with Water Weighing Device.

One of the most interesting exhibits at the recent Chicago Cement Show was a new high drum Smith-Chicago paver equipped with a 14-foot swivel chute and operated by steam engine and boiler. It attracted a great deal of attention because of a number of new and valuable features, one of the most important of which is the automatic water measuring mechanism designed for accuracy.

In construction every part of the propelling and hoisting mechanism is perfectly aligned—the shafts, gears, brackets and boxes all being bunched on a one-piece casting rigidly supported right over the big rear axle. This eliminates sudden jars and strains, due to rough hauling and makes for increased durability and uninterrupted service. The hoisting and propelling mechanism and engine are enclosed in a steel house over the rear axle. Every part is readily accessible, and split boxes are used throughout so that the box caps can be removed quickly to facilitate repairs. Any gear or shaft may be easily removed without disturbing the remainder.

The paver is propelled through compensating gears direct to the rear axle. There are no chains. The compensating gears save power and cut the strain in going over rough roads or turning corners. The traction drive is through two high-speed cone clutches and the speed is one-half mile per hour, either forward or reverse. The paver is equipped with a worm gear steering device, the wheel being located close to the traction clutch lever.

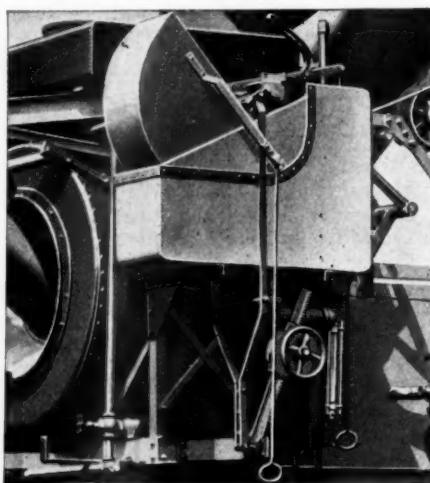
An 8½-foot wide skip distinguishes the No. 506 paver, and three men can dump their wheelbarrows simultaneous-

ly. This feature is, of course, a great time-saver. In the No. 510 paver the skip is eight feet wide, and in the No. 507, seven feet—and either of these will easily take two wheelbarrows at a time. The skip discharges the batch directly into the drum (there is no intermediate hopper to retard flow) almost instantaneously and without spilling. The skip travels up the inclined tracks on rollers so that no power is wasted.

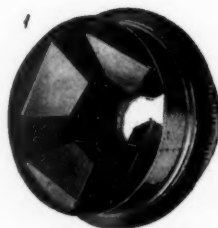
The interior of the drum is designed for producing a rapid but correct mix. The mixing action combines two distinct movements of the mass: A pour-

ing motion, which prevents separation into horizontal layers; an end-to-center motion, which eliminates vertical layers. The deep, steep-angled scoop blades, shown in the illustration, create a V-shaped flow of the mass to the center of the drum. The aggregate is caught by the long sloping walls and flows down in a deep, narrow, central stream. As it pours through the narrow opening it spreads out towards both ends in a wide horizontal stream which is caught by the next blade and brought back. Discharge is rapid, a complete batch, it is claimed, being turned out inside of 15 seconds. The concaved drum head allows the long, steep angled discharge chute to swing two-thirds of the way through the drum. The mix falls only a short distance from the blades and slides down rapidly and smoothly.

The water question is one of the most important in the proper mixing of concrete. Good concrete requires proper proportions accurately measured. The new Smith-Chicago water device weighs the water necessary for each batch and automatically pours it into the drum. There are no float valves or water gauges to watch, as the action is positive and automatic and is regulated by a simple sliding weight. Tanks and levers are so arranged that the water can be started into the drum just ahead of the batch



NEW WATER-WEIGHING DEVICE.



THE DRUM.



NEW SMITH-CHICAGO HIGH DRUM PAVER WITH WIDE THREE-MAN SKIP.

and continues flowing in along with it. As the skip comes up it operates a bell crank and lever, which dumps the water from the tilting tank into the lower and from this the water flows directly into the drum through the lower part of the feed opening. As the skip is lowered the weighted balance arm swings back the tipping tank, which refills automatically.

A long swivel chute with a steep angle of 20 degrees from the horizontal is designed to solve the problem of rapid distribution. In the No. 516 paver, for instance, the high drum allows a 16-foot chute at the 20-degree angle. The batch can be discharged at once—even when the chute is at right angles to the machine. The swivel chute, the intermediate openings and the auxiliary chute allow concreting over the entire radius of the spout without moving the machine and without much shoveling. The rapidity of flow prevents settling or separation. It is claimed that this distribution saves five seconds per batch.

These numerous automatic actions and the concentration of hand operations make the paver a one-man machine. One lever works both forward and reverse propelling clutches. All levers, gauges, etc., can be handled from the ground. An automatic knock-off disengages clutch when skip has reached its highest point. The power may be easily converted into an intersection machine by removing the swivel chute and substituting a gated receiving hopper. This may be filled ready for the cart while a new batch is being mixed.

The No. 507 paver was used last November by the Committee on Mixing and Placing of Concrete of the National Conference on Concrete Road Building in its experiments. Many very valuable results were brought out and the features described proved very useful in the work.

The accompanying illustrations show the machine from the skip and the chute end; the drum, and the water-measuring device. The paver is made by the T. L. Smith Company, 3114-A Hadley street, Milwaukee, Wis.

CEMENT TILE MACHINE.

Of Convenient and Serviceable Design.

The distinguishing characteristics of the Dunn cement drain tile machine are that all the mechanism is located in the base and that the packer head gives service both up and down. This construction permits double packing of the tile with extra packing at the bottoms. All working parts are enclosed in a single, solid casting which forms the base, putting weight where it is needed most and eliminating awkward angle iron construction and dust and dirt exposed mechanism. As there is no packer shaft inside the casing while it is being filled, the operation is rapid and single. Perfect alignment of all parts is assured so that the tile is of even thickness and density. The table

is waist high, so that the operator can stand erect at his work. The machine can be run by one, two or three men, depending on capacity required.

In operation, an empty casing is placed in the machine and is securely held and centered by the die and wearing rings. The floor of the casing is formed by the packer head. The concrete is placed in the casing and falls directly onto the revolving packer head, which immediately begins packing the bottom of the tile. It continues to do this until the foot lever is tripped, at which time the packer head starts upwards. On its way the packer head forms, packs and trowels the tile until it reaches the top of the casing. It then automatically returns, repacking and retroweling the inside of the tile. The top ring is then raised so that the casing containing the tile can be removed and another empty casing is put into position.

The automatic action of the packer shaft and the fact that the casing is not obstructed makes filling easy even for inexperienced help. The packer head revolves all the time so that there is additional packing at the bottom, making this the strongest part of the tile and thus obviating the need of up-ending. The packing action of both the up and return stroke gives a denser tile and allows a wetter mix to be used. The packer head makes 33 revolutions on its up stroke and 17 on the down—slow on the former and fast on the latter. The rotary motion is accomplished by miter gears connected with a pulley by a heavy cold rolled ground shaft.



DUNN CEMENT TILE MACHINE.

The speed of the shaft can easily be changed to suit conditions by using a different size sprocket wheel.

The design of the machine makes it more stable and permanent in its alignment than with the overhead construction, it is claimed. The whole machine will not catch dirt or dust. The casings are made of heavy galvanized steel, accurately rolled and well beaded. The patented fastener permits opening without jarring. The trowels are of special durable chilled steel. The shoes and trowel, subject to wear, may be replaced separately. The die rings are accurately machined and are fitted with inexpensive wearing rings. Bronze bearings and cut steel gears are used.

Labor and time-saving extra devices include a feeding table for holding enough material for 25 or 50 tile; a clutch pulley; an elevator and hopper for carrying the material from the mixer to the machine. A four to six h.p. engine provides the power. The Dunn No. 1 machine, it is claimed, has a capacity up to 2,000 tiles per day and the size ranges from 3 to 12 inches inside diameter, all 12 inches long.

This capacity, it is said, may be almost doubled with the Dunn "Automatic" machine. It makes from 3,000 to 3,600 tile per day and has a range of ten sizes from 3 to 16 inches in diameter. The principle of it is the same as that of the No. 1 machine. The mix is discharged into the lower hopper and a regulated amount is placed on to the elevator. Buckets carry the material to the hopper above the machine and from here it falls into a box holding just enough for one tile. Meanwhile the casing carrier automatically places and locks an empty casing and the head comes up. The material falls in and packing begins automatically. The machine needs only one man to operate it and it is simple to control all the time.

The accompanying illustration shows the Dunn No. 1 machine. The machines described are made by the W. E. Dunn Manufacturing Co., Holland, Mich.

INDUSTRIAL NEWS

Cast Iron Pipe.—Chicago—James B. Clow & Sons were the successful bidders for 900 tons at Kenosha, Wis., and formal award of 4,300 tons at Cleveland has been made to the leading interest. At Knox City, Ind., 200 tons of cast iron pipe for a sewer; at Chicago, 450 tons of special pipe; at Cincinnati, 1,150 tons of high pressure pipe, and at Toledo, 1,000 tons of high pressure pipe, are now being awarded. Quotations: 4-inch, \$32.50 to \$33; 6-inch and larger, \$29.50 to \$30; Class A, \$1 extra. Birmingham—The United States Cast Iron Pipe & Foundry Company has resumed an idle pit in its Bessemer plant recently repaired, and work is rapidly nearing completion on two new pits. A good assortment of orders has been coming in, with the South show-

ing fairly well. Business is much better than a year ago and prices still tend upward. Sanitary shops are in receipt of encouraging orders for spring stocks. Quotations: 4-inch, \$28; 6-inch and up, \$25; 16-ft. lengths, \$1 extra. New York—Niagara Falls, N. Y., opened bids March 30 in its requirements for this year, estimated at about 2,400 tons. Hartford Conn., has opened bids on 1,565 tons 6 to 20 inches. Acushnet, Mass., opened bids April 3 on about 200 tons of 4 to 10 inch. Municipal lettings are not numerous at present, but the volume of private buying keeps up very well. Advance prices are due to high cost of labor and pig iron and other raw materials. Quotations: 6-inch, Class B and heavier, \$30.50; Class A, \$31.50.

Lead.—Lead is quiet but strong, with producers unwilling to sell for export even at premium prices. Quotations: New York, 8 cents; St. Louis, 8 cents.

The Robinson Fire Apparatus Mfg. Co., 4250-4260 North 20th street, St. Louis, Mo., making the well known Robinson fire apparatus since 1871, announces its entrance in the field as builders of heavy duty trucks and tractors. Only heavy service will be aimed for, the machines ranging from 80 to 120 h.p. The tractors are designed for 20 to 50 ton loads of trailers and for speeds from 10 to 25 miles an hour. Five types will be made: A, 80 h.p. chassis; B, 4 wheel 80 h.p. tractor; C, 2 wheel 80 h.p. tractor; D, 120 h.p. chassis; E, 120 h.p. 4 wheel tractor.

Road Surfacing.—Road surfacing, as distinguished from applications of oil for dust laying, is covered in principle and practice in a booklet, "Trinidad Liquid Asphalt," just issued by **The Barber Asphalt Paving Company**, Philadelphia, Pa. The essentials of successful "carpet coating" with asphaltic materials are fully explained. As illustrations the pamphlet contains photos of park drives, city boulevards, suburban streets and country roads resurfaced with liquid asphalt by both hot and cold applications. Full specifications, in the form of explicit directions for the laying of carpet coats, are included.

The Ransome Concrete Machinery Company, 115 Broadway, New York City, which was established in 1892 and incorporated in 1902 has just been reorganized with ample capital to enlarge and modernize its plant. Mr. E. L. Ransome, founder, remains with the company as chairman of the board of directors and consulting engineer, in recognition of his years of service and experience. Mr. Frank L. Brown, of San Francisco, formerly connected with the Carey and Moen Company, the Western Power Company and still identified with numerous Pacific coast enterprises, is the new president and manager. The board of directors includes Mr. G. F. Steele, representing a large majority of the preferred stock

which is owned by strong interests associated with the International Harvester Company, and who is the general manager of the News Print Mfg. Association; Mr. Howard K. Brooks, vice-president of the American Express Company; Mr. F. M. Smith of the Oakland Traction Company, the San Francisco Terminal Railways, and other Pacific coast businesses; and Mr. H. M. Brittan of Worcester, Mass., and San Francisco, who is a constructing engineer of wide experience. Mr. A. J. Norton is secretary of the company and Mr. J. J. Givens is treasurer.

The Continental Public Works Co., engineers and contractors, 2 Rector street, New York city, has issued a very beautifully gotten up booklet describing the many phases of its work and illustrating some notable examples. This firm designs, finances and constructs all kinds of public improvements including streets and roads, water supply and sewerage systems, etc. The service includes engineering, construction, laboratory and inspection, field work and supervision and bond purchasing. Some of the jobs described include the roads at the Ashokan Reservoir of the New York City water supply, claimed to be the largest single asphalt road contract ever awarded to one contractor in this country. Other work illustrated is in Chester, Pa., Borough of Queens, N. Y., Lake County, Fla., Norfolk, Va., Ginter Park, Va. and Midvale and Brunswick state highways, New Jersey.

NEWS OF THE SOCIETIES

(Continued from page 450.)

for ten years, beginning with 1917, of three-quarters of a mill on all taxable property of the state, to be outside of tax limitations. The fund is to be known as the State Highway Improvement Fund and is to be "subject without appropriation by the general assembly to be expended in the improvement of highways as now or may hereafter be provided by law." It is provided that the money may be used in co-operating with the federal government in highway improvement.

It is estimated that on the present tax duplicate the levy will raise annually \$5,250,000, which with local aid will bring Ohio's annual contribution to "better roads" to more than \$10,000,000.

Chautauqua County Highway Superintendents.

The annual meeting of the Chautauqua County Highway Superintendents was held at Fredonia, N. Y., March 15. There was to have been a session in the morning, but owing to the late arrival of trains and cars this was omitted.

The session was called to order by the vice-president, Henry Walldorff, of Dunkirk, in the absence of the president, James Skellie of Mina.

The principal business transacted was the annual election of officers, which resulted as follows: President, L. A. Bigelow of Portland; vice-president, Archie McKeever of Chautauqua; secretary-treasurer, C. J. Thompson of Carroll.

South Carolina State Firemen's Association.

Dates for the State Firemen's association meeting to be held in Orangeburg have been set for June 20, 21 and 22. The committees have been working for over six months in making preparation for this convention and firemen's tournament, which are expected to be the best ever given.

United States Civil Service

Mechanical and Electrical Inspector (Male), April 19, 1916.

The United States Civil Service Commission announces an open competitive examination for mechanical and electrical inspector, for men only, on April 19, 1916. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in the position of foreman of power plant at the Naval Proving Grounds, Indian Head, Maryland, at \$6.72 per diem, and vacancies as they may occur in any navy yard or other naval establishment of the United States or in the Department at Washington, D. C.

The duties of the position will consist in inspecting and supervising the installation being erected under contract for the Navy Department and conducting acceptancy tests upon same in order to insure safety and durability and to oversee the operation of those portions of the power equipment already in operation at the Naval Proving Grounds. After completion the appointee will be placed in charge of the plant if his services prove satisfactory. Competitors will be examined in the following subjects, which will have the relative weights indicated:

Subjects.	Weights.
1. Mathematical and practical calculations (comprising arithmetic, algebra and including problems involving quadratics, geometry, elementary problems in mechanics, use of slide rule, and the correct working out of results from given formulae)	25
2. Theory and practices of mechanical and electrical engineering, comprising theory, nomenclature, practical computations, and the construction and operations of simple machines and apparatus (competitors will be given a choice of questions on this subject)....	35
3. Training and experience.....	40
Total	100

Applicants for this position must have had at least five years' experience in mechanical and electrical engineering along similar lines to those required as outlined above. A bachelor's degree in engineering from a college or university of recognized standing will be considered as equivalent to two and one-half years of such experience.

ADVANCE CONTRACT NEWS

ADVANCE INFORMATION BIDS ASKED FOR

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information concerning it as early as possible; also correction of any errors discovered.

BIDS ASKED FOR

STATE	CITY	REC'D UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
STREETS AND ROADS				
Fla.	Jacksonville	Apr. 8	20,000 to 45,000 sq. yds. brick paving and wood curbing on docks and terminals	J. C. O'Dell, Gen. Manager, Realty Bldg.
O.	Ironton	Apr. 8	Paving with brick and concrete	F. A. Ross, Clerk, Pub. Serv.
N. C.	Asheville	Apr. 10	20,000 sq. yds. concrete and 15,000 yds. other pavements	F. L. Condor, City Secretary.
La.	Webster City	5 p.m., Apr. 10	15,000 sq. yds. pavement and 9,000 ft. curb and gutter (brick, concrete or asphaltic concrete)	A. C. Vollmer, City Manager.
Ind.	Lebanon	7.30 p.m., Apr. 10	Paving street	Walter Whitecotton, City Eng.
Ill.	Morrison	2 p.m., Apr. 10	40,830 yds. brick paving and 26,185 feet curb and gutter, estimated cost \$117,287	E. O. Hills, Co. Surveyor, Fulton, Ill.
N. Y.	Oswego	2 p.m., Apr. 10	14,275 yds. brick pavement, 1,063 yds. asphalt macadam on concrete base and 5,800 ft. combined curb and gutter	C. W. Linsley, Comr. Works.
Kans.	Kansas City	Apr. 10	Grading and macadamizing river road	County Commissioners.
Minn.	St. Paul	10.30 a.m., Apr. 10	Grading, curbing and paving with asphaltic concrete	August Hohenstein, Pur. Agt.
Cal.	Los Angeles	2 p.m., Apr. 10	Improving roads	H. J. Leland, Clerk, Bd. of Supvs.
N. D.	Bismarck	8 p.m., Apr. 10	Constructing crosswalks	R. H. Thistlewaite, City Aud.
La.	Perry	Apr. 10	Laying 30,000 sq. yds. of pavement	C. E. Wilson, Engineer.
Texas	Dallas	10 a.m., Apr. 10	8,000 sq. yds. asphalt macadam and 27,000 cu. yds. of grading	J. F. Witt, Engineer
Col.	Pueblo	9 a.m., Apr. 10	Grading, draining and paving streets	John Jackson, City Clerk.
N. Y.	Long Island City	Apr. 10	Grading, curbing and laying sidewalk and asphalt and granite block pavement	M. E. Conolly, Pres. Boro.
Mich.	Coldwater	1.30 p.m., Apr. 10	One mile of concrete road	County Road Comrs.
Fla.	Bronson	Apr. 10	29 1/2 miles or road	A. T. Hardee, Co. Clerk.
Fla.	Eustis	4 p.m., Apr. 10	Constructing pavements	Isham Randolph & Co., Engineers, Jacksonville, Fla.
O.	Euclid	Noon, Apr. 10	Grading, curbing and paving with brick or asphalt and constructing sidewalks	F. A. Pease Engineering Co., Marshall Bldg., Cleveland.
Pa.	Allentown	5 p.m., Apr. 10	600 tons crushed stone and one to ten carloads asphalt for Whitehall Township	Bascom and Sieger, Engrs., Allentown Bank Bldg.
N. J.	Camden	Apr. 10	Building concrete bridge and restoring road	J. J. Albertson, Co. Engr.
Miss.	Jackson	Apr. 10	Improving and graveling roads	J. L. Redfield, Edwards, Miss.
Mich.	Hartford	Apr. 10	Grading and paving with brick	W. J. Cleary, City Engr.
Ind.	South Bend	11 a.m., Apr. 10	Grading, paving and improving road	A. F. Wolf, Co. Aud.
O.	New Philadelphia	1 p.m., Apr. 10	Grading roads	R. H. Mussdorfer, Co. Aud.
Minn.	Moorhead	8 p.m., Apr. 10	Cement sidewalks and street crossings	R. G. Price, City Clerk.
Minn.	St. Peter	10 a.m., Apr. 10	Grading and graveling state roads (5 jobs)	W. H. Holtz, Co. Auditor.
Ill.	Cicero	8 p.m., Apr. 10	Constructing brick pavement	Charles Stoffel, Town Clerk.
Col.	Denver	11 a.m., Apr. 11	Furnishing material and constructing concrete curb and gutter	J. B. Hunter, Com'r of Impts.
Wis.	Milwaukee	10:30 a.m., Apr. 11	1,200 street signs and 600 posts	F. G. Simmons, Com'r of Public Works.
Mo.	Kansas City	Apr. 11	Paving 7 miles of streets, cost \$270,000	William Barclay, City Engr.
Wis.	Hartford	8 p.m., Apr. 11	Paving 4 blocks with creosoted block	City Clerk.
N. J.	Dover	Apr. 11	38,000 sq. yds. Amiesite or bit. mac.	W. H. Hoskins, Clk., Morris-town
Md.	Baltimore	Apr. 11	Paving, including 5,000 cu. yds. excavation	State Road Commission
N. J.	Belvidere	11.30 a.m., Apr. 11	8.2 miles bituminous macadam road	F. W. Salmon, Co. Engr., Natcong, N. J.
Me.	Augusta	Apr. 11	Construction of sections of state highway	Maine Highway Comn.
La.	Nevada	7 p.m., Apr. 11	21,000 sq. yds. asphaltic or reinforced concrete pavement	R. A. Davis, City Clerk.
La.	Benton	Apr. 11	Constructing roads, \$50,000 available	J. C. Logan, R. F. D. No. City Clerk.
Mich.	Saginaw	Apr. 11	Paving eight streets; cost \$76,000	W. H. Borgen, City Clerk
Minn.	Duluth	11 a.m., Apr. 11	Improving four streets	Samuel McGowan, Payma General.
D. C.	Washington	10 a.m., Apr. 11	Asphalt blocks for Navy Yard	City Engineer.
N. J.	Bayonne	Apr. 11	Improving 20 streets	Louis Stutt, Co. Clerk.
Neb.	Nebraska City	noon, Apr. 11	100,000 cu. yds. of grading	
N. Y.	New York	11 a.m., Apr. 11	Three miles bituminous macadam and brick highways at Kensico reservoir	Bd. of Water Supply.
Minn.	Hastings	2 p.m., Apr. 11	Grading 2 1/2 miles of road	P. A. Hoffman, Co. Auditor.
O.	Akron	11 a.m., Apr. 11	Paving and macadamizing roads (3 jobs)	U. G. High, Clk. Co. Comrs.
Ind.	Indianapolis	10 a.m., Apr. 11	Grading, paving and improving road	L. K. Fesler, Co. Aud.
N. C.	Gastonia	Apr. 12	Tarvia binding and repair work	O. G. Falls, Kings Mountain.
Wash.	Palouse	Apr. 12	19,000 yds. concrete paving, cost \$30,000	J. J. Johnson, City Clerk
O.	Cleveland	10 a.m., Apr. 12	Grading, draining and improving road	E. G. Krouse, Clerk, Co. Commissioners.
Ind.	Indianapolis	10 a.m., Apr. 12	Road oil and hardware for county highway superintendent	L. K. Fesler, Co. Auditor.
Ill.	Chicago	noon, Apr. 12	1,000 cu. yds. crushed limestone	South Park Commissioners.
N. Y.	Brooklyn	11 a.m., Apr. 12	Regulating, curbing and paving with asphalt	L. H. Pounds, Boro President.
N. Y.	New York	3 p.m., Apr. 13	Constructing fill along road in Brooklyn and excavating along park in the Bronx	Park Board.
La.	Shreveport	Apr. 13	9 miles of gravel road	J. T. Bullen, Parish Engr.
Texas	Bryan	10 a.m., Apr. 13	85 miles earth or gravel road and five miles bit. mac. or rock asphalt	Abney & McCormick, Engrs.
Wash.	Stevenson	1.30 p.m., Apr. 13	One mile of county highway	C. H. Neller, Co. Aud.
O.	Salem	Apr. 13	6,620 yards brick pavement, cost \$14,000	Director of Pub. Service

BIDS ASKED FOR

STATE	CITY	REC'D UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
O., Akron	11 a.m., Apr. 13.	Grading, draining, curbing and paving	U. G. High, Clerk Co. Comra.	
N. D., Valley City	2 p.m., Apr. 13.	Constructing 9 miles of road	C. W. Nelson, Co. Aud.	
Ind., Tipton	10 a.m., Apr. 13.	Grading, paving and improving road	Oscar Vanness, Co. Aud.	
N. Y., L. Island City	11 a.m., Apr. 13.	Grading and paving with asphalt, 9,050 sq. yds.; 40,000 wood blocks	M. E. Connolly, Boro Pres.	
O., Bucyrus	Apr. 14.	Paving Marion and Galion Pike	H. A. Keller, Engineer.	
S. C., Charleston	6 p.m., Apr. 14.	Curbing, constructing sidewalks and furnishing paving material during 1916	J. H. Dingle, City Engr.	
Ind., North Vernon	Apr. 14.	4,732 yds. first class pavement	Charles Miles, City Engr.	
N. Y., Buffalo	11 a.m., Apr. 14.	Paving several streets	A. W. Kreinheder, Supt. of Public Works.	
Utah, Salt Lake City	2 p.m., Apr. 14.	Widening road; constructing and repairing 10 reinforced concrete bridges	Thomas Homer, Co. Clerk.	
Neb., North Platte	2 p.m., Apr. 14.	45,000 sq. yds. brick, asphalt or concrete pavement and 5,700 ft. concrete curb	C. J. McNamara, City Sngr.	
O., Cincinnati	Noon, Apr. 14.	Completing grading and culvert contract	Albert Reinhardt, Clk. Co. Comrs.	
Neb., Falls City	Apr. 14.	Street paving, estimated cost \$19,520	Geo. Riechers, City Clerk.	
Ind., Fort Wayne	10 a.m., Apr. 14.	Two or four-wheel portable heating kettle	Will Johnson, Co. Auditor.	
Ind., Danville	Apr. 15.	Constructing township roads	C. M. Havens, County Auditor	
Ky., Elkton	Apr. 15.	Eight miles macadam, probable cost \$24,000	A. B. Wilkins, County Judge	
Ala., Clanton	Apr. 15.	Constructing gravel road	R. L. Kenan, Co. Engr.	
Ind., Muncie	10 a.m., Apr. 15.	6,100 ft. road construction	F. M. Williams, Co. Aud.	
Ind., Bluffton	2 p.m., Apr. 15.	2 1/2 miles gravel and macadam road	C. T. Kain, Co. Aud.	
Mich., Sheridan	10 a.m., Apr. 15.	9 miles 10 to 14-ft. gravel road	J. M. Beem, Twp. Clerk.	
Ky., Elkton	Apr. 15.	8 miles macadam road, cost \$24,000	A. B. Wilkins, Co. Judge.	
Mich., Houghton	Noon, Apr. 15.	13 miles of macadam road	R. Martin, Engineer.	
O., Wooster	Apr. 15.	Improving streets	O. A. Glerow, City Engr.	
Pa., Hazleton	Apr. 15.	40,000 yds. brick or other paving, cost \$89,000	B. E. Youngman, City Engr.	
O., Batavia	Apr. 15.	Constructing three miles of pavement	L. H. Lersn, Engineer, State Hwy. Dept., Columbus.	
Ind., Columbus	10 a.m., Apr. 16.	Grading, paving and improving roads (3 jobs)	W. H. Scott, Co. Aud.	
Kansas, McPherson	noon, Apr. 16.	40,579 sq. yds. asphaltic concrete pavement and 29,348 feet combined curb and gutter	H. A. Rowland, City Engineer.	
Ind., Highland	8 p.m., Apr. 17.	Macadamizing road and constructing sidewalk	H. S. Daugherty, Town Clerk.	
Ind., Goshen	8 p.m., Apr. 17.	Paving with brick, bitulithic, asphalt or asphaltic concrete	City Engineer.	
Cal., Los Angeles	2 p.m., Apr. 17.	Improving several roads	H. J. Leland, Clk., Co. Supvra.	
Conn., Hartford	Apr. 17.	32,200 sq. yds. sheet asphalt pavement	Board of Contract & Supply	
Ala., Selma	Apr. 17.	Constructing 5 1/2 miles gravel road	W. O. Crisman, Co. Engr.	
Ia., Marion	Apr. 17.	Paving 16 blocks	H. R. Green, Engr., Cedar Rapids.	
Fla., Lake City	7.30 p.m., Apr. 17.	21,000 sq. yds. sheet asphalt or brick and 23,000 ft. concrete curb	C. R. Horne, Engr.	
Neb., Norfolk	Apr. 17.	Street paving in four districts	P. F. Stafford, City Clerk	
Fla., Starke	Apr. 18.	Paving and sewers, \$45,000 available	J. E. McCrary, Co. Engrs, Atlanta, Ga.	
Ky., Shepherdsville	Apr. 18.	Thirteen miles county road	W. C. Herps, Co. Rd. Engr.	
Okla., Lawton	2 p.m., Apr. 18.	Constructing driveway, sidewalk, curb and gutters	R. P. Sanders, Comr. Public Property.	
Fla., Bartow	Apr. 18.	240 miles brick, asphalt and asphaltic concrete roads, cost, \$1,000,000	H. S. Jaudon Engineering Co., Savannah, Ga. (and Box 334 Bartow, Fla.)	
Neb., Lincoln	2 p.m., Apr. 18.	Grading and paving	H. E. Wells, Co. Clerk.	
Ill., Berwyn	8 p.m., Apr. 18.	Constructing cement sidewalks	O. N. Lindahl, Sec. Bd. Local Impr.	
Wis., Marinette	2 p.m., Apr. 18.	11,000 sq. yds. reinforced concrete pavement	A. L. Hillis, City Engr.	
Pa., Northumberland	8 p.m., Apr. 18.	7,440 yds. brick pavement, 4,000 ft. concrete curb and 2,200 cu. yds. of excavation	S. Homer Derk, Clk. of Council.	
Ind., Fort Wayne	10 a.m., Apr. 18.	Furnishing crushed stone	Will Johnson, Co. Auditor.	
Minn., Luverne	10 a.m., Apr. 18.	Constructing state road	Olaf Skyberg, Co. Auditor.	
Fla., Sarasota	Apr. 20.	Grading 19 miles; 28 miles sand-asphalt road	County Commissioners.	
O., Urbana	Apr. 20.	Improving streets, estimated cost \$10,000	E. F. Sweetman, City Engr.	
N. Y., Albany	1 p.m., Apr. 20.	Improving 13.75 miles state highways	Edwin Duffey, St. Hwy. Comr.	
Ala., Lafayette	Apr. 24.	Constructing 16 miles sand-clay roads	J. J. Robinson, Jr., Probate Judge.	
W. Va., Weston	Apr. 24.	Improving three miles of road	Leander Troxell, Clerk, Co. Comrs.	
La., Shreveport	Apr. 25.	6 miles of gravel road	J. T. Bullen, Parish Engr.	
O., Bucyrus	Apr. 25.	Improving 12 streets, about 100,000 sq. yds.	F. L. Niederheiser, City Engr.	
Ia., Britt	Apr. 25.	26,600 yds. first-class pavement and 15,500 ft. of curb	T. S. DeLay, Engineer, Creston, Ia.	
Ind., Frankfort	2 p.m., Apr. 27.	Constructing roads	Edward Spray, Co. Aud.	
Tenn., Jackson	Apr. 30.	55,000 yds. vitrified brick paving	H. M. Harris, Comr. of Sts.	
Ill., Pontiac	May 1.	8,000 sq. yds. brick pavement, cost \$30,000	J. C. Wade, Engr.	
Ky., Hazard	May 1.	1 1/2 miles brick, concrete or macadam pavement	City Clerk.	
Ind., Jeffersonville	10 a.m., May 1.	Grading, paving and improving road	G. W. Stoner, Co. Auditor	
O., Gallon	May 1.	Paving Grove Avenue; cost \$30,000	A. F. Unckrich, Dir. Pub. Serv.	
Minn., Eveleth	May 1.	Paving streets; estimated cost \$20,000	C. H. Williams, City Clerk.	
Ind., South Bend	May 1.	Paving 21 blocks; cost \$70,000	Board of Public Works.	
Neb., Winlock	May 1.	One mile concrete pavement; cost, \$12,000	City Clerk.	
Ind., Marion	May 10.	Four miles of road construction (about \$5,000 per mile)	M. McCrea, Co. Auditor.	
S. D., Madison	May 15.	17,000 sq. yds. of paving	C. A. Trimmer, City Engr.	
Ky., Greenville	June 1.	Six miles macadam and dirt road, \$20,000 available	J. N. Fentress, Co. Clerk.	
SEWERAGE				
Ind., Winamac	Apr. 8.	4 miles of drainage ditch	C. E. Paul, Construction Comr.	
Okla., Oklahoma City	2 p.m., Apr. 10.	Ditch for diverting river channel	H. C. Adams, Co. Surveyor.	
N. C., Madison	Apr. 10.	Storm and sanitary sewers, Imhoff tanks, sludge bed and ejector station	C. L. Armsby, Clerk.	
Minn., St. Paul	10.30 a.m., Apr. 10.	Constructing sewers in several streets	August Hohenstein, Pur. Agt.	
N. Y., Long Is. City	11 a.m., Apr. 10.	Constructing 12 to 60-in. vitrified pipe and reinforced concrete sewer	M. E. Connolly, Boro. Pres.	
Ill., Kenilworth	8 p.m., Apr. 10.	Enlarging and improving drainage ditch	F. W. Coolidge, Village Clerk.	
Kan., Ellis	Apr. 10.	Sewer system to cost \$30,000	W. E. Tulse & Co., Engineers.	
S. D., Winner	Apr. 10.	Constructing sewer system, cost \$22,000	Hutchinson, Kan.	
Conn., New Haven	Apr. 10.	Sewers in several streets	Claude Maule, City Aud.	
Wis., Oshkosh	2 p.m., Apr. 10.	Outlet for storm and sanitary sewer	F. L. Ford, City Engr.	
Ia., Keokuk	6 p.m., Apr. 10.	Constructing 8 in. sewer	Board of Public Works.	
N. J., Montclair	Apr. 10.	Concrete and vit. pipe storm sewer	O. W. Sandberg, City Clerk.	
Ill., Madison	Apr. 10.	35,000 ft. tile sewers, cost \$155,000	E. S. Closson, Town Engr.	
Fla., Eustis	4 p.m., Apr. 10.	Constructing sanitary sewer system, Imhoff tanks, sludge drying bed and pneumatic ejector station; constructing storm sewer system	W. Champion, Secy. Bd. Local Improvements.	
Ind., Hammond	10 a.m., Apr. 10.	Constructing sewer	Isham Randolph & Co., Engineers, Jacksonville, Fla.	
			Board of Public Works.	

BIDS ASKED FOR

STATE	CITY	REC'D UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
Wis.	Oconto Falls	7 p.m., Apr. 10	1,470 ft. 10 to 24-in. sewer and 5 manholes	William Campbell, Village Clk.
Utah	Logan	8 p.m., Apr. 10	Tile drainage for 2,500 acres of land	Logan Land & Drainage Co.
Minn.	St. Peter	8 p.m., Apr. 10	Constructing sewer	M. E. Stone, City Clerk.
Ont.	Toronto	noon, Apr. 11	Constructing sewers in six streets	Works Department, City Hall.
N. J.	New Brunswick	10 a.m., Apr. 11	Constructing sanitary trunk sewer	C. A. Oliver, Sr., Dir. Sts. and Pub. Improvements.
Minn.	Hastings	Apr. 11	Constructing drainage ditches	P. A. Hoffman, Co. Aud.
Ark.	Rector	8 p.m., Apr. 11	6 miles 8 to 12-in. sewers, 79 manholes, 29 flush tanks and settling tank	F. L. Wilcox, Engr., Syndicate Trust Bldg., St. Louis
Md.	Baltimore	noon, Apr. 11	2,000 ft. of sewer with manholes, etc.	State Road Commission
N. Y.	Brooklyn	11 a.m., Apr. 12	Constructing many sewers, 12 to 114-in. diameter, mostly brick	L. H. Pounds, Boro. Pres.
Minn.	Redwood Falls	1 p.m., Apr. 12	Drainage ditches, cost \$120,788	L. P. Larson, Co. Aud.
N. Y.	Binghamton	Apr. 12	Constructing sewers in several streets	Board of Contract & Supply.
N. Y.	Schenectady	Apr. 12	Electrically-driven sewage pump	Board of Contract and Supply
N. Y.	Brooklyn	11 a.m., Apr. 12	12 to 18-in. pipe sewers (furnishing and constructing) equipment for sewage pumping station	L. H. Pounds, Boro. Pres.
Tex.	Port Arthur	2 p.m., Apr. 12	Constructing drainage ditches	L. D. Heckman, City Clerk.
O.	Cincinnati	noon, Apr. 13	Constructing sewers in Oskamp avenue	C. F. Hornberger, Dir. Public Service.
O.	Cleveland	noon, Apr. 13	Constructing several sewers	Commissioner of Engineering.
O.	Cleveland	noon, Apr. 14	Furnishing and placing ejector and drain piping at pumping station	Deputy Comr. of Water.
Minn.	Little Falls	Apr. 14	Two short sewer extensions	Victor Schallern, Clerk, Board Public Works.
Minn.	Windom	1:30 p.m., Apr. 14	Constructing three tile ditches	S. A. Brown, Co. Auditor.
Wis.	New Lisbon	7:30 p.m., Apr. 14	Furnishing and laying 15,500 ft. 8 to 12-in. sewers, 29 manholes, 2 flush tanks and 11 lampholes	W. G. Kirchoffer, Mgr., Vroman Bldg., Madison, Wis.
Fla.	Jacksonville	8 p.m., Apr. 14	Constructing 18 miles 8 to 54-in. sanitary and storm water sewers	L. D. Smoot, Comr. Pub. Wks.
S. C.	Charleston	6 p.m., Apr. 14	Furnishing 8 to 14-in. terra cotta pipe for 1916	J. H. Dingle, City Engr.
Wis.	New London	8 p.m., Apr. 15	Sanitary sewers in several streets	C. J. Thompson, City Clerk.
Pa.	Hazleton	Apr. 15	2,800 ft. 24 to 54-in. sewers, cost \$22,000	B. E. Youngman, City Engr.
S. D.	Watertown	Apr. 17	Motor-driven centrifugal pumps and other equipment	F. W. Schreiber, City Engr.
Neb.	Norfolk	5 p.m., Apr. 17	Extending Park avenue storm sewer	P. F. Stafford, City Clerk.
N. Y.	New York	10:30 a.m., Apr. 17	Drainage and ditching or filling salt meadows in Brooklyn and Queens	Haven Emerson, Pres. Board of Health.
R. I.	Woonsocket	Apr. 18	5,700 ft. 8 and 10-in. sanitary sewers	Frank Mills, City Engr.
Minn.	Wabasha	Apr. 18	Constructing sewers (complete)	J. M. Schouweiller, City Recorder.
Fla.	Starke	Apr. 18	Sanitary sewer system	J. B. McCrary Co., Engrs., Atlanta, Ga.
N. J.	Bayonne	4 p.m., Apr. 18	Laying 185 ft. of sewer	William P. Lee, City Clerk.
N. Y.	Oriskany	11 a.m., Apr. 19	Constructing sewer system and disposal plant	City Clerk.
N. Y.	Binghamton	Apr. 19	Sewer construction, estimated cost \$150,000	W. Earl Weller, City Engr.
N. Y.	Albany	3 p.m., Apr. 20	Sewers in several streets	Bd. of Contract and Supply.
O.	Urbana	Apr. 20	Storm sewers, \$12,900 available	E. F. Sweetman, City Engr.
Ill.	St. Francisville	1 p.m., Apr. 20	Redredging ditches, requiring 92,000 cu. yds. excavation	G. C. Harvey, Engr., Mt. Carmel.
Argentina	Buenos Aires	Apr. 24	Furnishing machinery	Dept. Obras Sanitarias de La Nacion.
N. Y.	Binghamton	Apr. 26	Change of date for main intercepting sewer	W. Earl Weller, City Engr.
O.	Xenia	noon, Apr. 27	Sewage disposal plant, cost \$70,000	A. P. Shumaker, City Engr.
Quebec	Westmont	Apr. 30	Furnishing sewer pipe, cement, sand and bricks for 1 yr.	Secretary-Treasurer.
Minn.	Anoka	May 1	Constructing sewers, probable cost \$55,000	City Clerk.
Tex.	Amarillo	May 1	Sewer system and disposal plant; cost \$10,000	M. H. Hardin, City Engineer.
N. J.	Lyndhurst	May 20	Constructing sewers; cost \$200,000	Bowe & Wessells, Engineers, Rutherford.
WATER SUPPLY				
Tex.	Fort Worth	9 a.m., Apr. 8	14,357 ft. 36 and 48-in. c. i. steel or concrete conduit	M. P. Harwood, Jr., City Sec.
Tenn.	Lenoir City	noon, Apr. 8	Repairs to water works plant	W. U. Shipley, City Recorder.
D. C.	Washington	Apr. 8	Steel and iron pipe, castings and lead pipe	General Purchasing Officer, Panama Canal
Md.	Indian Head	Apr. 8	High pressure system at Naval Proving Grounds	Bureau of Yards and Docks, Navy Dept., Wash., D. C.
O.	Euclid	noon, Apr. 10	Constructing 6 and 8-in. water mains	F. A. Pease Engineering Co., Marshall Bldg.
Va.	S. Boston	Apr. 10	Filter plant building, coagulating basin, pumping station, etc.	Anderson & Christie, Engrs., Charlotte, N. C.
Ia.	Fort Dodge	Apr. 10	Sinking well	W. L. Tang, City Clerk.
Ala.	Florence	noon, Apr. 10	Constructing filtration plant complete	C. E. Jordan, Comr. Pub. Prop.
O.	Youngstown	10 a.m., Apr. 10	About 600 ft. concrete and c. i. pipe, 12 to 30-in.	F. H. Vogan, Clk. Co. Comrs.
Minn.	St. Paul	10:30 a.m., Apr. 10	Drilling and casing 8-in. well	August Hohenstein, Pur. Agt.
Cal.	Berkeley	3 p.m., Apr. 10	55,000 gal. re-conc. reservoir; 160,000 gal. earth reservoir; 6,900 ft. pipe lines	Comptroller, Univ. of Cal.
O.	Cleveland	noon, Apr. 11	Furnishing lead pipe and brass fittings	Deputy Commissioner of Water.
Ont.	Collinwood	8 p.m., Apr. 11	Motor driven pumps and pump well	Water & Light Commission.
Ont.	Toronto	noon, Apr. 11	Electrically operated driving gear for 36-in. valves	Works Department, City Hall.
N. Y.	Ilion	2 p.m., Apr. 11	Covered filter beds, clear water basin and control house with piping, etc.	J. D. Ringwood, City Engr.
Wis.	Hayward	Apr. 11	50,000 gals. steel tank and tower and two pumps	Village Clerk.
Ark.	Rector	8 p.m., Apr. 11	5 miles 4 to 8-in. c. i. pipe line, pumping station, valves, tower, tank and hydrants	F. L. Wilcox, Engr., Syndicate Trust Bldg., So. L. Mo.
Mont.	Three Forks	5 p.m., Apr. 12	Installing water works system, including water mains and concrete reservoir	Village Clerk.
Ia.	Berger	10 a.m., Apr. 12	Excavating and lining 400-bbl. cistern	J. H. Smith, City Engineer, Boise.
Mont.	Billings	10 a.m., Apr. 12	Digging wells, laying mains and building tank and pump station	F. E. Williams, County Clerk.
N. J.	Atlantic City	Apr. 13	Laying 17,500 ft. 8 to 20-in. c. i. pipe and setting 100 hydrants; furnishing and driving 15,000 ft. of piles	L. Van Gilder, Engr., Water Dept.
Wis.	New Lisbon	7:30 p.m., Apr. 14	Furnishing and laying 8,000 ft. 4 to 6-in. c. i. pipe, 7,000 lbs. specials and 15 hydrants	W. G. Kirchoffer, Engineer, Vroman Bldg., Madison, Wis.
Va.	Blackstone	3 p.m., Apr. 14	9,000 ft. 4-in. c. i. pipe, 60,000 gal. steel tank, pumps, oil engines, etc.	R. B. Stone, Clerk of Council.
S. C.	Charleston	6 a.m., Apr. 14	Furnishing iron pipe and castings for 1916	J. H. Dingle, City Engr.
Minn.	Gemmill	2 p.m., Apr. 15	Drilling a deep well	Bd. of Education, Dist. No. 2.
Minn.	Silver Lake	8 p.m., Apr. 16	Constructing waterworks system	Bernard Pawlak, City Rec.
Neb.	Norfolk	Apr. 17	Extending water mains and system	P. F. Stafford, City Clerk

BIDS ASKED FOR

STATE	CITY	RECD UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
Okla.,	Wellston	7:30 p.m., Apr. 17	Constructing waterworks, including 9,600 ft. c. i. pipe	Benham Engineering Co., Colcord Bldg., Okla. City, Okla.
Tex.,	Lockhart	Apr. 18	Water works, electric light plant and ice plant	H. E. Elrod, Engr., Dallas, Tex.
Miss.,	McComb	Apr. 18	1,500 feet 4-in. water mains	L. H. Marsalis, Clerk.
S. D.,	Lake Norden	10 a.m., Apr. 18	Waterworks and electric light and power system, complete	R. C. Byrde.
Mont.,	Harlowtown	Apr. 20	Constructing water works system	G. E. Baker, Engr., Whitehall, Mont.
Mass.,	Lynn	10 a.m., Apr. 20	3,000,000-gal. horizontal centrifugal pump and one 200-h. p. electric motor	Thos. Campbell, 2nd, Comr. Water & W. W.
Wis.,	Madison	Apr. 24	Constructing pump house at University	State Ch. Engr., Capitol Bldg.
Ore.,	Yoncalla	May 15	46,520 feet 6 to 10-in. wood or steel pipe, 2,680 ft. 2-in. pipe, rock filled dam and concrete lined reservoir	M. B. Germond, Engineer, Roseburg, Ore.
MISCELLANEOUS				
Fla.,	Jacksonville	Noon, Apr. 8	Constructing marginal wharf	J. C. O'Dell, General Manager, Realty Bldg.
N. D.,	Bismarck	8 p.m., Apr. 10	Removal of garbage and ashes for 1916	R. H. Thistlethwaite, City Au.
Ind.,	Indianapolis	10 a.m., Apr. 11	Automobile for highway superintendent	L. K. Fesler, Co. Aud.
N. Y.,	New York	11 a.m., Apr. 11	Heating system in Kensico gate chambers	Board of Water Supply.
Minn.,	Wheaton	1 p.m., Apr. 11	Constructing three drainage ditches	J. T. Erickson, Co. Auditor.
N. Y.,	Buffalo	11 a.m., Apr. 14	Dredging Buffalo river	A. W. Kreinheder, Supt. of Public Works.
Ky.,	Louisville	Apr. 15	Portland cement	U. S. Engineer's Office
Ind.,	Richmond	11 a.m., Apr. 15	Driving 120 16-ft. piles loam	L. S. Bowman, Co. Auditor.
Minn.,	Breckenridge	Apr. 15	Drainage ditch, 4 bridges and culvert; cost \$5,400	T. E. Truax, Co. Auditor.
Minn.,	Wadena	10 a.m., Apr. 17	Drainage ditch, cost \$4,250	Eugene Boss, Co. Auditor.
N. Y.,	New York	11 a.m., Apr. 18	Furnishing and erecting nine 5 to 20-ton electric traveling cranes at Ashokan, Kensico and Hillview reservoirs	Board of Water Supply.
Mont.,	Butte	Apr. 19	Constructing incinerating plant	City Clerk.
S. C.,	Charleston	Noon, Apr. 21	Summer uniforms for police department	J. A. Black, Ch. of Police.

STREETS AND ROADS

Birmingham, Ala.—Petition for sidewalk, gutter and curb on 38th St., Wylam, from Chester to Oak St., was referred to city engineer.

Tucson, Ariz.—Petition will be sent to council asking that contract for city hall work be awarded to home bidder employing home labor and purchasing his supplies in Tucson. Committee considering the bids is expected to recommend to council that contract be awarded to Weymouth Crowell, Los Angeles contractor, who submitted lowest estimate, \$47,620, and who has been building Masonic Temple on Scott St. Local contractors who bid on structure were: Reed & Dow, \$53,516; M. L. Tophoy, \$57,500, and J. A. Graf, \$55,000. Crowell is on local "unfair" list, and it is alleged that he employs non-union labor and buys his supplies outside of Tucson. He is \$6,000 below next lowest bidder, but above limit of \$45,000 available under bond issue. Petition will accompany protest filed with city clerk Mar. 25 by Tucson Central Trades Council, requesting that all bids received be rejected and new ones called for on ground that lowest bid is higher than money allowance available for erection of proposed structure.

Balboa, Cal.—At regular meeting, Mar. 21, the South Coast Improvement Association mapped out route for proposed coast road and agreed upon recommending it to board of supervisors. In building of such a road, however, it was pointed out there is no doubt but that there will be some obstacles to overcome, chief among which will be construction of two bridges across bay, permission for building of which would have to be secured from government and in accord with government plans. Also, it was pointed out, to consummate proposed plan for highway it would be necessary to secure right of way through the lands of James Irvine Co.

Pasadena, Cal.—For first 2.47 miles of the Arroyo Seco road to Antelope valley, cost will be \$25,769, according to estimates prepared by F. H. Joyner, county road commissioner, and submitted to county supervisors Mar. 20. Big items of cost are \$9,712 for excavating, \$5,500 for bridges and \$9,080 for concrete retaining walls.

Sacramento, Cal.—Council has ordered improvement of several streets by curbing, guttering and laying of sewers.

Santa Ana, Cal.—City contemplating bond issue of \$10,000 for purchase of truck which will be combination roller and oil distributor, grader and scarifier.

Stockton, Cal.—Council will order improvement of several streets by curbing, guttering and constructing sidewalks.

Yreka, Cal.—At a meeting of Chamber of Commerce, resolutions were adopted and forwarded to State Highway Commission, asking latter to begin work of

making approaches to completed bridges between Yreka and the Oregon line from both ends at once, in order to complete road for travel at very earliest possible moment.

Waterbury, Conn.—Board of Public Works will reject all bids received for road oil because they are too high.

Colorado Springs, Colo.—Approximately \$100,000 will be spent by county of El Paso on roads this year, according to announcement by County Commissioners.

Pueblo, Col.—Council has approved ordinance ordering certain construction replacements, renewals and repairs in Court St. and Grand Ave. paving district.

Trinidad, Col.—City Council has ordered issuance of \$82,000 worth of street and bridge refunding bonds. E. H. Rollins & Sons will be purchasers.

Georgetown, Del.—Last step in completing full right of way for du Pont Blvd. through Sussex county was taken Mar. 22, when only property standing between Sussex and Kent county lines was condemned at \$952 for 13 acres of land on back of farm. It is understood that General T. C. du Pont will now start engineers at once through Kent county, surveying routes. Probably three different routes will be surveyed before any one is decided upon definitely. Work of building the road from Georgetown will be put out to bids just as soon as weather permits. Bids will be offered on four and six-mile stretches.

Lakeland, Fla.—Polk county will hold election in May to vote on bond issue for building 240 miles of roads.

Ottawa, Ill.—City Engineer George Farnsworth is now preparing estimates for resurfacing business part of Ottawa, north of Lafayette St.

Springfield, Ill.—City discussing plans for paving of Third St. along Alton right of way between Adams and Washington Sts.

Booneville, Ind.—At special election recently Boone township voted in favor of 23 miles of rock road by a majority of 218. The system extends out of Booneville on 11 roads.

Green Castle, Ind.—Successful bidders for four sets of Putnam county road bonds were: Twenty bonds of \$240 each, premium \$96.26; 20 bonds of \$255 each, premium \$103.05, and 20 bonds of \$432 each, premium \$179.10, Meyer-Kiser Bank; 20 bonds of \$165 each, premium \$63.50. J. F. Wild & Co.

Indianapolis, Ind.—Forty Pike Twp. residents were before Marion county commissioners Mar. 25 asking improvement of Lafayette Pike between Flackville and Trades Point, a distance of 5 miles. It was proposed that commissioners resurface road with stone, continuing such work as was done on pike last year between 16th St. and Flackville. Commissioners promised to view highway next week and residents said

petition formally asking the improvement would be filed soon with the board.

Jasper, Ind.—Road bonds totaling \$4,900 were sold to Breed, Elliott & Harrison, of Indianapolis for premium of \$117.60. They bear 4½% interest.

Portland, Ind.—Three issues of brick road bonds, each for \$18,000 were sold by County Treasurer Kuder Mar. 27 at a premium of \$1,106, being bid in by R. R. Raney. Five other concerns offered proposals.

Shelbyville, Ind.—Two petitions will be presented to county commissioners at April term for making cement roads out of sections of free gravel roads branching out from this city.

South Bend, Ind.—Five bids were recorded on Keasey St. pavement from Michigan to Carroll Sts. at meeting of board of works Mar. 28. Bids for general repair work of various streets of the city were referred to engineer. Resolution calling for a sewer along Frances St. from South Bend Ave. to Sorin St. was adopted by board and hearing was set for latter part of April. Petition for a curb, sidewalk and a 3-in. gravel pavement on Logan St. from Scott to Leland Ave. was examined by board and a resolution was ordered.

Warsaw, Ind.—Council has passed resolutions for pavements on four streets, about two miles in all.

Cedar Falls, Ia.—Representatives of Hawkeye Oil Co. appeared before Council Mar. 27 and submitted samples and prices of crude oil for road-making purposes. No action was taken, but it was intimated that Council might at some time in near future receive sealed bids for certain amount of crude oil to be used on outlying streets this summer.

Muscataine, Ia.—City plans big paving program. C. H. Young, City Engineer, has been instructed to prepare estimates of cost of improvement.

Sac City, Ia.—At mass meeting of taxpayers of Sac county Mar. 22 addressed by D. W. Norris, of Marshalltown, resolution was adopted approving plan of board of supervisors to complete permanent grading and graveling of county road system within next three years, and issue bonds in anticipation of regular county road tax to complete payment for work.

Storm Lake, Ia.—Board of supervisors of Buena Vista County will grade and gravel entire county road system within three years and issue bonds upon 20-year serial payment plan for expense, as result of mass meeting held in this city Mar. 25.

Newton, Kan.—Ordinance has been adopted providing for paving and curbing and guttering of 5th St. from east side of intersection of 5th St. and Poplar St. on east to Santa Fe St. on west.

Pleasanton, Kans.—Bourbon County good roads boosters completed work Mar. 24 of securing valid petitions for rock road entirely across county along

route of proposed Jefferson Highway. In addition to providing for rock road all along the Jefferson Highway across the county, the farmers have either secured necessary signers under Hodges law or have nearly done so for about thirty miles more.

Campton, Ky.—County Judge B. D. Rose has called an election for May 6 on question of issuing bonds in sum of \$50,000 to be expended in constructing good roads in this county.

Carlisle, Ky.—It is learned that about \$93,000 is available for good roads work in Nicholas County this year. County will receive about \$8,000 this year from State under State aid.

Edmonton, Ky.—At election Mar. 25 Metcalfe county voted \$30,000 in bonds for building roads.

Georgetown, Ky.—Several important steps were taken Mar. 23 at meeting of advisory committee of Scott County Good Roads Association. State Road Department will be asked to send civil engineer to Georgetown to outline cost of reconstructing roads, and they will advertise for road engineer to superintend construction of all highways which bond issue funds will cover. Fiscal Court will probably buy rock quarries within few miles of each other on all of these pikes.

Hopkinsville, Ky.—Christian county plans reconstruction of 200 miles of pike and building of 50 miles of new pike under general supervision of Kentucky department of roads and J. A. Whitaker, an expert of United States roads bureau.

Lexington, Ky.—City contemplates paving of Morton's alley. Cost of various kinds of materials, according to estimates of City Engineer J. White Guyn, will be as follows: Sheet asphalt, total cost \$3,226.50, \$2.15 per abutting foot; brick, total cost, \$3,192.50, \$2.13 per abutting foot; concrete, total cost, \$2,261, \$1.50 per abutting foot; type C asphalt, \$2,827.50, \$1.88 per abutting foot.

Louisville, Ky.—Plans being discussed for extension of Eighteenth St. road from Stower's Grove to Postoria with rock asphalt.

St. Sterling, Ky.—Montgomery fiscal court has filed application with State Aid Association asking for appropriation under good roads law of \$12,000, to be used in work of improving roads in this county. If court succeeds in getting amount asked for it will be used in construction and repair of Owingsville, Winchester, Paris and Camargo Turnpikes.

Owensboro, Ky.—Bids for 75,000 gallons of oil for use on streets of Owensboro were opened in office of Mayor Hickman Mar. 25. There were but two bids submitted, one by Standard Oil Co. and another by Christoline Oil Co. Oil that was favorable to two street committees, whose chairman met with mayor, was one guaranteed to contain 60 per cent asphaltum base. This will cost 5½ cts. gal., just 1 ct. higher than last year.

Paducah, Ky.—Commissioners have passed resolutions calling for ordinances for improving several streets by paving, graveling and constructing sidewalks.

Baton Rouge, La.—Committee composed of leading citizens of Iberville, Pointe Coupee, West and East Baton Rouge parishes, now has in hand project of building model road from Port Allen to Rosedale and Maringouin, 16 miles long, along line of the old Louisiana Central railroad.

Hempstead, L. I.—Town Board of Hempstead, Mar. 28, at weekly meeting approved recommendation of Town Superintendent Archibald G. Patterson, that sum of \$121,650.17 be spent on improvement of roads in town for ensuing year.

Jawood, L. I.—Work will be started soon on sewer in Bayview Ave. and when it is completed Supervisor Smith is prepared to have Bayview Ave., from Lawrence station to White City, paved with asphalt block, on concrete foundation. McNeill Ave. and Sheridan Blvd. are to be rebuilt.

Annapolis, Md.—City administration has determined to ask of Legislature authority to issue new loans for public improvements, and to this effect three bills are now pending. One is for a million-dollar stock issue for extension of city electrical conduits. Another is for \$1,000,000 for school buildings and the third is for \$2,000,000 to be used for streets in present Annex. Under this bill there is created an Annex Commission, composed of Commissioners for Opening Streets, but it is stipulated that

work they are to do may be turned over to Paving Commission.

Hagerstown, Md.—At meeting of Board of County Commissioners Mar. 28 a number of road matters were taken up by Board. Delegation from Smithsburg district appeared with petition for a road between Smithsburg and Leitersburg. Members of delegation agreed to furnish some material and labor for road. Matter was referred to Road Committee for that district. Large delegation from Fairview section, near Cearfoss, appeared and asked that road about 4 miles in length in that section be improved. Petitioners also agreed to furnish material and labor. Matter was referred to Road Committee.

Great Barrington, Mass.—Senator John B. Hull received a letter Mar. 27 from state highway commissioners, outlining work that they propose to do in this section during year. A mile of state road will be constructed from Molasses Hill section toward Egremont, and two miles will be built from under mountain section toward Egremont. There will be 5,000 ft. of concrete construction on middle Sheffield Rd. south of Great Barrington. About 14,000 ft. of same road will be constructed in Sheffield. Commission will also appropriate \$20,000 for improvement of Monument Mountain, providing town will set aside sum of \$10,000 for work. From top of Monument Mountain section of state road will be constructed as far as Peggy's Brook on Stockbridge Rd. Small towns surrounding will come in for their share of road work under small town act which protects them at all times.

Haverhill, Mass.—Council contemplates widening of Emerson St. and Oak St.

Holyoke, Mass.—Plans for proposed new street to be cut between High and Railroad St. between City Hall and the City Hall Annex have been prepared by City Engineer T. J. McCarthy and submitted to Board of Public Works. Plans call for roadway about 27 ft. wide and 7 ft. sidewalks on each side.

Lynn, Mass.—Orders for bond issues amounting to \$130,000 were adopted by council Mar. 24. One was for \$100,000 to provide funds for street paving, and other for \$30,000 for drainage construction.

New Bedford, Mass.—Bids for a year's supplies for street work were opened Mar. 28 by Supt. of Streets William P. Hamersley. Twenty-four bidders were represented. Bids will be tabulated and submitted to board of aldermen at its next meeting, when contracts will probably be awarded. Bids were as follows: Granolithic sidewalk—B. Sykes, \$1.15 per sq. yd.; Loftus & Dugan, \$1.90. Bituminous Road Binder—New Bedford Gas & Edison Electric Light Co., 4 cts. at works and 5 cts. per gallon delivered; United States Asphalt Co., A, 9½ cts. f. o. b. New Bedford; B, 9½ cts. f. o. b. New Bedford; Atlantic Asphalt Co., A, \$.0918, B, \$.0674 B, in tank cars; A, \$.0918, B, \$.0908, barrels; A, \$.1184, applied to roads, \$.1174 applied to roads in tank cars; American Tar Co., C, \$.10 per gallon; \$.081 in tank cars, \$.1223 applied to roads; American Tar Product Co., C, \$.075 per gallon; Barrett Mfg. Co., \$.099 per gallon in barrels, \$.0785 in tank cars, \$.13 delivered and applied to roads; Independent Coal Tar Co., \$.0975 per barrel in carloads, \$.0775 in tank cars, \$.10 applied in tank cars, \$.135 in truck loads applied. Bituminous Road Oil—New Bedford Gas Co., \$.02 per gal. at works; \$.03 delivered on job; John Baker, Jr., 30 per cent grade, \$.071 per gal.; 45 per cent grade, \$.062; Atlantic Refining Co., 30 per cent, \$.0643; 45 per cent, \$.0643; American Tar Product Co., \$.07 per gal.; Indian Refining Co., \$.0672 for 45 per cent grade; Barrett Mfg. Co., \$.0635 per gal. Asphalt Cement—Barber Asphalt Co., \$.20.66 per ton f. o. b. New Bedford; Atlantic Asphalt Co., \$.0699 per gal. in tank car, f. o. b. New Bedford; \$.083 in barrels, f. o. b. New Bedford; United States Asphalt Refining Co., \$.21.50 per ton. Sewer Castings—Fairhaven Iron Foundry Co., \$.11.50 for manhole castings, \$.3 per catch basin cover; Levison Foundry Co., \$.9.90 for manhole castings, f. o. b. New Bedford; \$.2.90 for catch basin covers, f. o. b. New Bedford. Broken Stone—New Bedford-Dartmouth Granite Co., size 1, \$.1.45; No. 2, \$.1.45; No. 3, \$.1.45; F. G. Rose, No. 1, \$.1.15; No. 2, \$.1.25; No. 3, \$.1.35; Charles Desrosiers, No. 1, \$.1.40; No. 2, \$.1.40; No. 3, \$.1.40; delivered; New Hampshire Trap Rock Co., No. 1, \$.1.55; No. 2, \$.1.60; No. 3, \$.1.70;

shipped by water, No. 1, \$.1.30; No. 2, \$.1.35; No. 3, \$.1.45; Sullivan Granite Co., No. 1, \$.1.50, delivered south of Union St.; \$.1.40 north of Union St. Non-asphaltic Road Oil—Indian Refining Co., \$.095; M. E. Lemery, Boston, \$.09 f. o. b. New Bedford; Dustaline for Roads Co., \$.0975 gal. with discount of \$.025 if more than 30,000 gals. are used during season. Cement—Willard M. Petty, \$.1.84, 8 cts. rebate on bags; Moses A. Denault, \$.1.87; from storehouse, \$.1.88; 10 cts. rebate for bags and 5 per cent discount for cash; Paisler & Willis, \$.1.87 in carloads; \$.1.93 from storehouse, 9 cts. rebate for bags. Limestone Dust—Moses A. Denault, \$.6.61 per ton; 9 cts. for bags; Willard M. Petty, \$.7.10, 9 cts. rebate for bags, or \$.5.70 delivered in paper bags.

Pittsfield, Mass.—Commissioners state that another mile of road leading from "Molasses Hill" toward Egremont is to be built, two mile stretch along the Under Mountain Rd. in Sheffield towards Egremont is also to be built, and 5,000 ft. of concrete road in this town on middle road to Sheffield and 14,000 ft. of same kind will be constructed in Sheffield. This job will be started as soon as weather will permit. Should town appropriate the sum of \$10,000 state will contribute \$20,000 more towards improving conditions on Monument Mountain and commissioners give assurance that contract for this work will be given within 10 days after town votes money.

Pittsfield, Mass.—Town contemplates bond issue in sum of \$700,000 for following purposes: Paving, \$200,000; Tucker and high schools, \$400,000; municipal yards \$60,000, and sidewalks \$20,000.

Bay City, Mich.—During the year it is expected hundreds of miles of Dixie Highway, loop of which passes through Bay City, will be constructed. Arrangements are being made for building of large sections of road from Mackinaw, northernmost city it will touch, to southern extremity, Miami, Florida. Much of highway is now completed.

Battle Creek, Mich.—Rival routes for proposed Michigan-Chicago-Detroit paved way were discussed Mar. 24 at a conference of executive committee of the highway association. Atty. A. B. Williams, of Battle Creek, president of the association, presided over the sessions at the Post Tavern. Advocates of two routes presented their claims. The way is planned from Detroit to Paw Paw, via Ypsilanti, Ann Arbor, Jackson, Battle Creek and Kalamazoo. At Paw Paw south route lies through Niles and Dowagiac, while north route goes to Benton Harbor and St. Joseph, following shore of Lake Michigan into Chicago. The south route advocates say that theirs is the natural one to follow, and further, that at Niles it would connect with the Lincoln Highway. The north routers argue that the St. Joseph way is a mile shorter, and that by Sept. 1, 1916, all but 2 miles of the road between Paw Paw and New Buffalo, the points of contact with the Detroit-Chicago highway, will have been constructed of cement, to a width of 16 ft. It is believed compromise will be reached whereby highway will use both routes.

Covert, Mich.—Town will vote shortly on proposition to issue bonds in sum of \$25,000 for roads.

Dowagiac, Mich.—President Ralph W. Hain, of Cass County Farmers Institute Society, is in favor of \$200,000 road bonding question. He regards it as a cheaper and more efficient method of building good roads than one now in use.

Flint, Mich.—Plans and specifications for sidewalks for ensuing year have been approved by Council and City Clerk was instructed to advertise for construction of sidewalks in accordance with plans and specifications. Each bid was to be accompanied by a \$100 certified check.

Kalamazoo, Mich.—New pavements to amount of \$85,000 will be laid in Kalamazoo during coming summer by action of city council Mar. 27 in accepting recommendations of street committee for bond issue. About \$35,000 will be expended in general improvements, such as fixing street intersections. Estimate of City Engineer Andrew Lenderink on various street costs and his resolution that certain streets be paved, were both adopted by council. Streets to be paved and their costs follow Alcott St., from Burdick to Portage St., of asphaltic concrete, \$11,079.50; Lincoln Ave. from Phelps Ave. to Wallace Ave., of asphaltic concrete, \$12,046.20; Woodward Ave. from Kalamazoo Ave. to North St., of asphaltic concrete, \$8,184.20; Oak St. from Lovell to Cedar, of asphaltic concrete,

\$2,225.40; Elm from Main to Monroe, of asphaltic concrete, \$11,968.30; Grand Ave. from Main to Monroe St., of asphaltic concrete, \$4,063.60; Frank St. from Burdick to the G. R. & I. tracks, of brick, \$7,191.67; Portage from Alcott to city limits, of brick, \$14,389.10; Patterson from G. R. I. tracks to Lake Shore, of brick, \$6,049.48; Pitcher from Patterson to Lake Shore tracks, of brick, \$7,802.55.

Kansas City, Mo.—See "Miscellaneous."

Kansas City, Mo.—Council has passed several ordinances for paving.

Saginaw, Mich.—Paving work to be done on eight streets and to cost \$76,000 was approved by council Mar. 21 and bids were asked for Tuesday, April 11. Pavements will be laid this coming season. Largest contracts are on Washington Ave., Tuscola to James Ave., and on State, Michigan Ave. to Bond St.

Sault Ste. Marie, Mich.—State Highway Commissioner Rogers has written to county commissioner that state will adopt portions of Pickford and Mackinaw roads, within city limits, which were recently taken over by county as part of county road system, as a part of state trunk line highway. Total amount of road is two miles and third and state reward money for this will amount to about \$7,000.

South Haven, Mich.—By a vote of 1-006 to 187, March 21, resolution to bond for \$50,000 for public improvements, all of which will be devoted to securing factories except about \$15,000. April 3 this township will vote to bond for \$50,000 for good roads, \$25,000 being for improvement on highways and \$25,000 for building stone roads.

Chisholm, Minn.—With levy of \$75,000 made at town meeting in town of Balkan considerable work is planned. Levy is divided as follows: Road and bridge fund, \$68,000; general fund, \$4,000, and construction of new town hall, \$3,000.

Duluth, Minn.—Winona county will issue \$500,000 in bonds, and the proceeds will be devoted to highway improvement during coming summer. This is the only Minnesota county to finance its road-building in this manner this year, so far as state highway commission has been informed. Several other counties, however, have adopted ambitious road building programs. Among these are St. Louis, where \$615,000, raised by county levies and the state apportionment is to be spent, and Redwood county where record amount of graveling is to be done. Ramsey county will spend \$120,000 on roads this year, and Hennepin county \$200,000.

Nicholas, Minn.—Town at annual meeting this year made levy of \$40,000, most of which is intended for improvement of roads.

St. Paul, Minn.—McClure Contracting Company is lowest bidder on contract for paving Selby St. Its bid is \$84,450, while City Engineer Claussen's estimate is \$88,818.

Joplin, Mo.—City contemplates paving 20th St., between Main and Annie Baxter Sts.

Billings, Mont.—Sealed proposals will be received by board of county commissioners of Yellowstone County, Montana, until 12 o'clock, noon, of Monday, April 17, 1916, at the office of the county clerk at Billings, Mont., for purchase of 175 coupon bonds of denominations of \$1,000 each, proceeds of which shall be used for purpose of building approximately 47 miles of macadamized public highway in Yellowstone County, Mont. F. E. Williams is county clerk.

Billings, Mont.—First step in construction of 47-mile graveled highway across Yellowstone county was taken Mar. 24, when board of county commissioners appointed R. H. Murray engineer in chief of construction and John Edy, assistant engineer, chief assistant. Next step will be the deciding on specific material to be used in construction of highway and letting of contracts. It is understood road will be 10-ft. graveled or macadamized highway with crushed rock and clay for base and probably an oil tar mixture to augment binding. Several outside companies, it is reported, have submitted specifications of road construction which will be tried out.

Asbury Park, N. J.—Bids for laying concrete sidewalks and curbs have been received and referred to committee for compilation. Lowest bid was 99-10 cts. per sq. yd. for sidewalks and 20 cts. a lineal foot for curb.

Atlantic City, N. J.—Director Thompson's ordinance providing for building of Absecon Blvd., connecting up with boulevard which is to be built by free-

holders, was passed on first reading before commissioners Mar. 24. Ordinance provides that road shall be constructed starting at Virginia Ave., and extending to northwest bank of Clam Thorofare, thence from northeast corner of Slam Thorofare to southeast corner of Beach Thorofare. Benefits are to be assessed against abutting properties along which new boulevard will run. No one appeared at the meeting to object to the passage of ordinance.

Keypoint, N. J.—Borough council met Mar. 21 at special session in the borough hall to receive the specifications from county engineer for new cement road to be built in Broad St. south of railroad tracks. Specifications were accepted by the full board and O. K'd and were then sent to Contractor Cooper, who will present them before state board for approval, after which they will be returned and bids will be advertised for.

Newark, N. J.—Board of Street and Water Commissioners has adopted resolutions for paving Beaumont Pl. and for paving and widening Halsted St. M. R. Sherrard is Chief Engineer.

Ocean City, N. J.—Hearing was given here Mar. 25 by George W. T. Miller, assistant engineer of War Department, in application of Cape May County Board of Freeholders for permission to construct solid fill road embankment across Weakfish Creek and Middle Thorofare at Corson's Inlet, in connection with building of proposed Ocean City-Corson's Inlet boulevard. A large number of witnesses were heard, and bulk of testimony was against closing either channel.

South River, N. J.—After discussing conditions on Willett Ave. and George St. Council unanimously decided to include them in streets to be improved by laying of uniform concrete sidewalks and curbs. Two streets are about one mile long. With all improvements completed South River will have about three and one-half miles of new sidewalk and total of about five miles.

Buffalo, N. Y.—Report has been filed by appraisal commission appointed to determine value of property taken by city in opening new street from Crowley Ave. to Skillen St. Awards made by the commission for the 3,000-ft. street total \$25,859.40.

Forestville, N. Y.—By unanimous vote citizens of this village voted Mar. 22 to accept gift of \$6,000 from Mrs. Elizabeth McManus for paving of Water St. under certain conditions. Total vote cast was 88. Second proposition, providing for paying to Mrs. McManus sum of \$300 annually for 20 years or until her death, was carried.

Hudson, N. Y.—The \$113,000 4 1/2 per cent Columbia county highway bonds were sold Mar. 29 by County Treasurer John Connor to Crandell, Sheppard & Co., of New York City, highest bidders, for \$115,505. This means premium of \$2,505.

Lockport, N. Y.—Purchase of steam roller or stone crusher has been recommended to board.

Lockport, N. Y.—Board has decided to expend \$1,600 on grading and ditching of roads in various parts of town. Two appropriations of \$500 each were voted for improvement of Irish Rd., running from Pendleton to Beach Ridge Rd., and clay road from Pickard's Bridge to Bear Ridge. This makes a total of \$2,600 for road work.

Lockport, N. Y.—Highway committee of board of supervisors has voted to recommend improvement of following roads in order named, under county and town system of county roads: Fillmore-Chapel-Ransomville road in Lewiston and Porter, distance of about four miles; Beebe-Chestnut road in Wilson, distance of about six miles; Warrens Corners road from the Ridge to the Lockport city line, about two miles; the Pendleton-Wheatfield town line road, about three miles.

Malone, N. Y.—Special election will be held April 11 to vote on bond issues of \$45,000 and \$33,000 for road improvement and constructing park system. Richard D. Rice is Village Clerk.

Malone, N. Y.—If proposed bond issue is favorably voted on it is probable that village will expend about \$125,000 on road work this season. H. H. Seaver is City Engineer.

Newburgh, N. Y.—Contract for construction of Middletown-Montgomery state road No. 499, will be among first to be let this spring. Distance is 9.03 miles. Unionville-Jersey line road, with distance of .30; the New Hampton-Denton road, of .66, and the Greenwood

Lake-Tuxedo road, of 3.79 miles, all making total mileage of 4.75, grouped under No. 500, will probably be let coming fall. The Goshen-Middletown road, No. 501, with distance of 5.25 miles, would be let by fall if no change is made in present arrangements. Montgomery-Bullville line, No. 576, a distance of 7.51 miles, will probably be advertised by fall and let next spring.

Newfane, N. Y.—At meeting of town board Mar. 20 it was decided to pay township's assessed share of cost of new Lockport-Olcot state improved highway, in eight annual installments of \$1,525 each, town's share of cost being \$12,200. Amount will be raised by taxation. State road had been completed before town officials became aware that part of cost would devolve upon town. Misunderstanding was due to a change in state laws of which they had not been advised.

Newfane, N. Y.—Town has about \$9,000 available this year for highway repairs.

Niagara Falls, N. Y.—Niagara county's share of anticipated \$50,000,000 for good road work in New York state, to be received from \$10,000,000 to be received annually during next five years, will reach \$735,000. Of this sum, however, only \$147,000 will be available this year. Highway committee of the board of supervisors has tentatively agreed to a program of highway work under county and town system for coming summer. Committee has voted to recommend at April meeting of board improvement of Fillmore Chapel-Ransomville road in Porter and Lewiston, six miles long; the Beebe-Chestnut road in Wilson, six miles long; Warren's Corners road in town of Lockport, two miles long, and connecting city with route No. 30, and Pendleton-Wheatfield town line road between Pendleton and Wheatfield for a distance of about three miles.

Rochester, N. Y.—Following final ordinances have been adopted: Ernestine St., grading walks and sewer, \$4,800; Colonial Rd., grading, walks and sewer, \$16,000. Westchester Ave., asphalt pavement, \$24,000; Main St. East, cement walks from Franklin St. and East Ave. to University Ave., \$9,000; Woodbine Ave., asphalt pavement, \$5,000; Zeigler St. widening, Chapin St. to Randolph St., \$3,000.

Utica, N. Y.—Following bids were received Mar. 23, for repairs on asphaltic pavements: Harry W. Roberts & Co., \$2.40 per sq. yd. for new sheet asphalt, and \$1.34 per sq. yd. for resurfacing with sheet asphalt. Total amount of bid, \$7,610. Paving Margaret St. from Butterfield place to Oneida St.: Harry W. Roberts & Co., sheet asphalt, natural curb, \$13,630.30; artificial stone curb, \$12,575.80; Bitulithic, natural curb, \$14,490.50; artificial curb, \$13,436. Asphaltic concrete, natural curb, \$13,031.90; artificial curb, \$11,977.40. Greenwood court, Holland Ave. to Oneida St.: Harry W. Roberts & Co., sheet asphalt, natural curb, \$8,285.25; artificial curb, \$7,606.30. Bitulithic, natural curb, \$8,808.50; artificial curb, \$8,129.55. Asphaltic concrete, natural curb, \$7,921.25; artificial curb, \$7,242.30. Hampden place, Carlisle Ave. to Thistle Rd.: Harry W. Roberts & Co., sheet asphalt, natural curb, \$3,654; artificial curb, \$3,325. Bitulithic, natural curb, \$3,903.60; artificial curb, \$3,574.60. Asphaltic concrete, natural curb, \$3,487.60; artificial curb, \$3,158.60. Thistle road, Genesee St. to Hampden Place: Harry W. Roberts & Co., sheet asphalt, natural curb, \$1,956.25; artificial curb, \$1,776. Bitulithic, natural curb, \$2,055.85; artificial curb, \$1,875.60. Asphaltic concrete, natural curb, \$1,889.85; artificial curb, \$1,709.60. Cromwell Pl., Carlisle Ave. to city line: Harry W. Roberts & Co., sheet asphalt, natural curb, \$3,868.41; artificial curb, \$3,531.36. Bitulithic, natural curb, \$4,151.61; artificial curb, \$3,814.56. Asphaltic concrete, natural curb, \$3,679.61; artificial curb, \$3,342.56. Franklin St., Catharine St. to the north line of the Erie Canal: Harry W. Roberts & Co., sheet asphalt, natural, \$1,337.20; bitulithic, natural, \$1,422; asphaltic concrete, natural, \$1,310.70. John R. Baxter, Jr., vitrified brick, natural curb, \$1,724.50. Frank M. Johnson, vitrified brick, natural curb, \$1,371.40. Property owners will have 10 days in which to make selections after the publication of bids. Contracts will be awarded by board after taxpayers have made their designations for paving.

Durham, N. C.—Movement is on foot for building Durham-Chapel Hill Blvd. Plan was first launched in Chapel Hill during early part of March. Since that

time it has been learned that boulevard construction companies have offered to build seven miles of the 12 free. According to Mr. R. O. Everett, chairman of Chamber of Commerce committee, remaining five miles will not cost less than \$30,000.

Minot, N. D.—City commission has taken under advisement following bids for paving about 15 blocks bounded by Central and 2d Aves. and by 1st St. S. W. and 3d St. S. E.: S. Birch & Sons' Construction Co., creosoted wood block, \$85,313.58; bitulithic, \$71,938.80; brick block, \$90,357.98. S. A. Riches, creosoted wood block, \$83,027.16; reinforced concrete, \$71,344.88. Woodruff & Son, creosoted wood block, \$84,695.48. Hanlon & Oakes, creosoted wood block, \$82,103; bitulithic, \$70,300; reinforced concrete, \$70,300; brick block, \$87,268.

Cincinnati, O.—Board of County Commissioners of Delaware County, Ohio, will sell road bonds to amount of \$50,000 on Thursday, April 20, 1916, at hour of 1 o'clock p. m., at office of county commissioners of Delaware County, Ohio. W. N. Aldrich is auditor, Delaware County, Ohio.

Cincinnati, O.—County commissioners have received a petition from Pleasant Ridge Welfare Association asking for improvement of Lester road.

Hamilton, O.—President Edward Hamann of county commissioners stated that he would father resolution with the commissioners providing for levy of one mill for improvement and maintenance of Butler county roads. This will give commissioners \$115,000 a year.

Hamilton, O.—County highway superintendent Hammerle has completed survey of roadway which State Highway Department proposes to build near Columbia bridge to prevent section of river road from sliding toward river. Present roadway between bridge site and first culvert south would be abandoned as public highway and new road built around back of hill along river. Division Engineer Lersch accompanied Engineer Hammerle and commissioners in an examination of proposed routes.

Hamilton, O.—At next meeting of Council petition from property owners of North C St. will be presented, asking that that thoroughfare be paved as soon as possible. Majority of property holders have signed petition.

Hamilton, O.—See "Water Supply."

Hanoverton, O.—Village has made proposition to county commissioners, which if board acts favorably upon it, will provide for improvement by Tarvia of a stretch of road six-tenths of a mile long, just west of village. Commissioners have taken no action. Petition signed by large number of property owners of Middleton township was presented to commissioners, asking that East Carmel Anchor road, running east from the Rogers-Clarkson road, east to Rogers, East Palestine road by improving by grading.

Jefferson, O.—Sealed bids will be received at office of board of county commissioners of Ashtabula county at Jefferson, O., until 1 p. m., April 24, for purchase of road bonds in sum of \$76,000. B. E. Brainard is clerk.

Massillon, O.—Election will be held April 25 to vote on following bond issues: \$2,865 for graveling E. Tremont St., \$8,000 for rebuilding fire and police alarm systems, \$9,000 for paving Canal St., \$1,500 for paving Pine St.

Salem, O.—Council has approved ordinance authorizing improvement of Maple St. by grading, curbing and paving.

Youngstown, O.—Council will be petitioned for widening of Watt St. from Front St. to Erie Railroad.

Youngstown, O.—Bids were opened Mar. 28 for five road contracts. About nine miles of road will be improved with macadam as soon as Commissioners determine who will get contracts. Low bids were as follows: McGuffey Rd., Coitsville township, 1.57 miles, K. J. Smith, \$11,504.20 (seven bidders); Matthews Rd., Boardman township, 0.26 miles, Kennedy Brothers, \$2,026.81 (three bidders); Damascus-Berlin Rd., Berlin township, sections 3 and 4, 2.9 miles, J. D. Paxson, \$25,436.51 (ten bidders); section 5 of same road, 2.01 miles, Kennedy Brothers, \$17,683.03 (six bidders); Poland-North Lima Rd., Springfield township, 2.08 miles, Kennedy Brothers, \$17,420.75 for macadam with other bids on different treatments (four bids).

Chester, Pa.—Council has passed ordinances providing for paving of several roadways.

Erie, Pa.—Council authorized first steps in preparing ordinance for special

election of May 16 at meeting Mar. 23. B. E. Briggs, city engineer, was instructed to prepare estimates of cost of covering Mill Creek, elimination of grade crossing and improving both branches of Garrison run and submit estimates to H. Bedford Duff, city solicitor. Ordinance proclaiming special bond issue election of May 16 will be prepared within short time and introduced in council.

Erie, Pa.—B. E. Briggs, city engineer, has been instructed to make plans and estimates of costs in construction of pavement in W. 4th St.

Erie, Pa.—City Engineer Briggs in resolution was instructed to communicate with Buffalo and Lake Erie Traction Co. with reference to early starting of work of paving 19th St. from Ash to Wayne St., and to report back to Council. He was also directed to advertise for bids for grading, curbing and paving of Brewster St. and for laying of sanitary sewer in 26th St. from East Ave. 700 ft. west. Proposals for both jobs will be received Thursday morning, April 6.

Harrisburg, Pa.—Commissioner Lynch Mar. 27 opened bids for motor truck, a street sweeper and combination sweeper and street sprinkler. Bids submitted are as follows: Street Sweepers—Studebaker, \$194; Good Roads Machinery Co., \$210; Austin-Weston Road Machinery Co., \$250 and \$300; Charles Hvass Co., \$519. Combination Sweeper and Sprinkler—Studebaker, \$245; Good Roads Machinery Co., \$260; Austin-Weston Road Machinery Co., \$400. Motor Truck—Hudson Sales Agency, \$2,200; Morton Truck & Tractor Co., \$2,350; International Motor Co., \$2,500; Garford Motor Car Co., \$2,350 and \$2,850; Harrisburg Auto Co., \$2,225, \$2,100 and \$2,000.

Johnstown, Pa.—Fourteen resolutions providing for street paving were placed on calendar Mar. 28, following their first reading before Council. Eleven of 14 provide for street improvement in the Seventh Ward. Three of these provide for asphalt paving on concrete base. Other resolutions provide for brick on concrete.

Lebanon, Pa.—There will be approximately \$35,000 available this year for repair work in Lebanon county, according to Henry L. Wilder, County Superintendent.

Middletown, Pa.—Board has set aside sum of \$6,000 for opening, maintaining and repairing roads. One of the first roads to receive attention will be Chambers road from borough line of Steelton to Bressler. Efforts are now being made to have at least one portion of State aid road made this spring and that will be from Mohn St. section from borough line to Enhaut, distance of 2,800 feet, at a cost of about \$10,000. Township authorities have made necessary applications and it has been approved by county and state, and work on this section will no doubt begin at an early date.

Wilkes-Barre, Pa.—Ordinance providing for widening of Filbert Lane, between Loomis St. and Essex Lane from 10 ft. to 20 ft., and for the opening and extending of Filbert Lane, from Essex Lane to Hazle St., a uniform width of 20 ft., and providing for appointment of viewers to assess damages and benefits therefor will come up for final passage April 7.

Newport, R. I.—Council contemplates widening of Bath Rd.

Providence, R. I.—City has purchased \$4,500 motor tractor of 40 H. P., to be used in connection with macadam street oiling project, which is to be undertaken this spring by Public Works Department.

Columbia, Tenn.—Mt. Pleasant to Columbia Blvd. will be built. That fact was assured at meeting of committee and boosters Mar. 24. Committee which has been soliciting funds for building of road reported that over \$7,000 of \$8,000 had been pledged. Assurances were given that balance necessary to raise total to \$8,000 would be forthcoming. It was then resolved that sum raised be tendered to state highway commission for construction of road and that those present pledge themselves to make every effort to obtain balance of \$8,000 required. State highway commission thereupon, through Secretary Murray, accepted offer and construction of the road will begin at an early date.

Hutto, Tex.—Hutto precinct is to vote soon on \$50,000 bond issue for good roads to connect with Meridian Highway.

Salt Lake City, Utah.—Unanimous approval was given by city commission to action by joint city and county commit-

tee on protection of Big Cottonwood water in deciding that Salt Lake shall contribute \$7,500, county \$12,500 and mining companies \$10,000 to widen and straighten road in lower canyon to permit use of traction trains to handle ore instead of teams.

Norfolk, Va.—Mayor Mayo Mar. 27 signed council joint resolution appropriating \$27,000 for improvement of four Norfolk county roads leading out of city.

Bellaire, W. Va.—Resolution has been passed declaring it necessary to issue bonds in sum of \$40,000 for purpose of paying city's share of cost of improving West 23d St. and West Washington St. by grading and paving.

Elkins, W. Va.—Voters in Leadville district in which Elkins is located Mar. 25 by a vote of about 5 to 1 declared themselves in favor of a \$250,000 bond issue for permanent improvement of 22 miles of roads in district.

Parkersburg, W. Va.—Revised Tygart district petition asking county court to authorize special election to vote for bond issue of \$70,000 for building of permanent roads in district, was filed at session of commissioners Mar. 25.

Warwood, W. Va.—Town contemplates bond issue for paving to be done on several streets.

Spokane, Wash.—Half a million dollars will be expended for improvements to existing roads and building of new roads in Spokane county this summer, first of work to start within next few weeks, according to announcement by County Engineer J. W. Strack and the county commissioners.

Spokane, Wash.—Plans are being discussed for paving on Grand Blvd.

Columbus, Wis.—Following bids were opened Mar. 28 for 12,000 sq. yds. asphalt pavement on 5-in. concrete foundation, 2,350 sq. yds. excavation; Rasmussen Sons, Oshkosh, Wis., at \$1.36 per sq. yd. for paving, 35 cts. excavation, total \$21,340; Butler Const. Co., Waukesha, Wis., at \$1.37 and 40 cts. respectively, total \$21,348; Nelson-Weber Co., Oconomowoc, Wis., at \$1.49 and 35 cts., respectively, total \$22,823. Benj. Paepke is City Clerk.

Milwaukee, Wis.—Contract will be let shortly for placing two-in. coat of bituminous concrete on macadam foundation on Layton Boulevard. Estimated cost somewhat less than 70 cents per sq.

Racine, Wis.—Sum of \$70,650 will be expended on roads of county coming summer, that amount being available this year. Highway commission is now working on the schedule for 1917. Amounts to be expended in various towns follow: Raymond \$7,200, Thompsonville and North Cape road and the Kneeland road; Rochester \$1,250, Burlington road and a bridge on the Honey Creek road; Waterford \$3,000, Waterford-Caldwell road; Yorkville \$6,000, Corliss-Union Grove road; Caledonia, \$19,500, Caledonia road, Franksville road and the Milwaukee road; Dover \$4,500, Kansasville and Norway road; Mt. Pleasant \$13,200, Twelfth St. road and Franksville road; Norway \$6,000, Waterford-Milwaukee road, North Cape-Waterford road, North Cape-Union Grove road. The county will spend \$9,000 on the 12th St. and Corliss roads.

Sheboygan, Wis.—Property owners are in favor of paving Calumet road the full width with concrete.

CONTRACTS AWARDED.

Fresno, Cal.—By city, for about \$150,000 worth of street work, to following: Worswick Street Paving Co., Thompson Bros., California Road & Street Improvement Co.

Redwood City, Cal.—Contracts for rebuilding of Crystal Springs road, from San Mateo to Halfmoon bay, have been let by the Board of Supervisors. 14 miles of job was awarded to J. McReynolds for \$60,199.47, and Eaton & Smith received contract for remainder for \$14,813.60.

Boulder, Colo.—To Jacobson, Severson & Doyle for construction of 3,000 ft. of road up Bulmer Gulch.

DeLand, Fla.—Contracts were awarded here Mar. 27 for approximately 58 miles of hard-surfaced roads. Contract for DeLand-Lake Helen district, with exception of about 6 miles of shell road construction between Lake Winnemisset and New Smyrna and 2 miles of asphalt construction between DeLand Junction and St. Johns River, was awarded to the Southern Clay Mfg. Co., of Chattanooga, Tenn., at a price of \$300,248.28. There

are about 26 miles of this road and construction is to be of Dunn wire cut grouted brick. Halifax district contract, with exception of DeLand-Daytona Rd. and some other shorter sections, was awarded to F. G. Proudfoot, of Chicago. This road is to be of asphaltic concrete with the exception of some 7 miles of shell construction. There are around 32 miles of road and the price is \$295,000. On the DeLand district the time limit is 365 calendar days and Halifax district is 210 calendar days. Actual construction will doubtless begin shortly.

Anderson, Ind.—For 235,722 sq. ft. concrete road with 6 and 8-in. foundation in Madison County to W. P. Master & Co., Anderson, at \$40,783.00.

Anderson, Ind.—For concrete road in Madison County to Daniels & Lipt, local, at \$46,390.

Elwood, Ind.—To Arcadia Cement Co., Atlanta, Ind. (Geo. Davis & Son, Contractors), for 4,617 sq. yds. cement sidewalk with old gravel foundation at 85½ cents per sq. yd. Eph. Rummel is City Clerk.

Elwood, Ind.—City Council has awarded to Davis Construction Co., of Arcadia, contract for more than two miles of new cement walks and is preparing contracts for an additional mileage of walks on south side early next month.

Fort Wayne, Ind.—For macadam roads to following: A. N. Fry, Bluffton, Ind., at \$10,200; Ellison & Co., Monroeville, Ind., at \$9,362.

Logansport, Ind.—For 12,000 sq. yds. sheet asphalt pavement on 5-inch concrete base, 4,000 cu. yds. gravel and clay excavation, to Andrews Asphalt Paving Co., Hamilton, Ohio, at \$1.95 per sq. yd., total bid \$36,216.00. H. H. Thompson is City Engineer.

Richmond, Ind.—First permanent street improvement contracts of year were awarded Mar. 28 by board of public works. Contract for paving of N. 5th St. from A St. to D St., with concrete, was awarded to Harding, Slattery & Buchanan on bid of \$1.48 a sq. yd. Lowest bid for brickwork these three squares was \$1.82 per sq. yd. Contract for paving of S. 9th St. from Main to A Sts. with asphalt, was awarded to Andrews Asphalt Co., of Hamilton, O., the same firm which put down the North A St. paving last year. The bid was \$1.88 per sq. yd., the same as the lowest bid on brick.

South Bend, Ind.—By city, to Loren H. Vander Kan, for repair work on all asphalt streets during the year.

Washington, Ind.—For county road construction as follows: Walsh Road, to L. T. Gootee, \$1,387; Smith Road, to Hugh McVain, at \$2,994; Emmick Road, Emmick & Campbell, \$1,384; Stotts Road, C. D. Russell, \$4,300; Meyers Road, C. D. Russell, \$3,320. All bidders from Washington, Ind.

New Orleans, La.—For 4,800 cu. yds. gravel road, 8-in. graded earth road foundation, 22,000 cu. yds. earth excavation to W. E. Geren, Columbia, La., at 65 cts. per cu. yd. for paving, 18 cts. per cu. yd. for excavation, total bid \$8,148. Price on gravel metal surfacing includes hauling and placing of material, etc., on road. Material furnished by Parish. Information relative Section 1, Marks-ville-Ville Platte Highway, Avoyelles Parish, Louisiana, approximately 3 miles highway, address Chas. Chauchon, Highway Dept. of Louisiana.

Beverly, Mass.—Contracts for laying of brick sidewalks have been awarded by public service committee to John C. Fowler who has had contract for several years. Contract for furnishing granolithic sidewalks was awarded to Mark E. Kelly Company, of Peabody, at \$1.62 a yard, low bidder. There were two bidders for curbstones, Lovejoy Granite Co., of Milford, N. H., who had the contract last year and Rockport Granite Co., both bidding 69 cents a foot. Contract was given to the Rockport Granite Co. Edmund M. Cahill was given contract for hauling and setting of edgestones.

St. Paul, Minn.—Council has awarded contract for furnishing labor and material necessary to do work of paving Portland Ave. from Dale St. to Lexington Ave., including sewer or house drains and water service connections, to Fielding and Shepley, at a price of \$50,602.67. Engineer's estimate, \$53,812.00.

St. Paul, Minn.—For paving on following streets to Fielding & Shepley: Laurel Ave., at \$30,265.30; Ashland Ave., at \$30,841.73; Hague Ave., at \$29,836.79; Victoria St. at \$19,401.91; Como Ave., at \$39,369.11. Bids include sewer or house drains and water service connections.

Chillicothe, Mo.—City council has awarded contract for paving of three

streets as follows: Second St. from Vine to Locust St. to John F. Meek. Paving, \$1.60; grading, 25 cts.; curbing, 30 cts.; oak headers, \$30 per 1,000. This paving is to be of brick. Edgewood Ave., Polk to Bryan St., to C. A. Stewart. Paving, \$1.12; grading, 25 cts., curbing, 28 cts.; oak headers, \$30 per 1,000. This pavement is to be of cement. Woodard St. from Polk to Calhoun St., to C. A. Stewart. Paving, \$1.65; grading, 25 cts.; curbing, 30 cts.; oak headers, \$30 per 1,000. This pavement is also to be of brick.

Kearney, Neb.—For 14,000 sq. yds. vertical fibre brick pavement on 3-in. concrete cement foundation, 3,550 cu. yds. excavation, to George Parks & Co., Omaha, Neb., at \$1.94 per sq. yd. complete. T. M. Hartzell is City Clerk.

New Brunswick, N. J.—Contracts have been awarded to Delaware and Raritan River Quarry and Construction Co. and F. R. Upton, of Newark, for supplying crushed stone for county roads. Company got the contracts for 22 roads and Mr. Upton for 6.

Rochester, N. Y.—When Board of Contract and Supply a short time ago opened bids for asphalt repairs for city for season of 1916 it was found that two firms were tied at lowest price in history of the city. While other cities throughout the state and country were paying from 25 to 50 per cent more than Rochester keen competition here served to keep bids down. Warren Brothers Co., of Boston, who had contract last year for 88 cents a sq. yd., was tied with Whitmore, Rauber & Vicinus this year, both offering to do the work for 74 cents a sq. yd. At meeting Mar. 29 decision was made to split work between two firms, each of which will do part.

Minot, N. D.—For 24,844 sq. yds. paving to Hanlon & Okes, Sioux City, Iowa.

Albany, Ore.—City council Mar. 23 authorized mayor and recorder to enter into contract with J. W. Travis for paving several blocks with asphalt concrete at \$1.05 per sq. yd.

Florence, Ore.—Florence city council awarded contract on road to North Fork to Fred Cassidy at bid of \$4,647.50, which was considerably under engineer's estimate.

Newport, R. I.—Contract for road oil has been awarded to Dustoline for Roads Co., at 9½ cents per gallon.

Sioux City, S. D.—Following contracts have been awarded for 75,000 sq. yds. asphaltic concrete pavement with 6-in. cement foundation: For 1 block to Warren Bros. Co., Boston, Mass.; bitulithic at \$2.10 per sq. yd., for 1 block to Fielding & Shepley, St. Paul, Minn., bitulithic at \$2.07 per sq. yd.; remainder to Western Const. Co., Sioux City, Ia., asphaltic concrete at \$1.59 per sq. yd. Walter C. Leyse is City Auditor.

Olympia, Wash.—State highway board awarded to Jarvis & Burkheimer, of Seattle, contract for graveling of 7½ miles on Pacific highway from Toledo south in Lewis and Cowlitz counties. Bid was \$13,652.80. Montague-O'Reilly Co., of Portland, was next lowest bidder with \$13,780.

Janesville, Wis.—Mayor James A. Fathers and City Clerk J. P. Hammarlund were authorized by City Council at meeting Mar. 25 to sign contract with Indian Refining Co. to purchase street oil at flat rate of 5 cts. per gallon.

Waukesha, Wis.—For 10,720 sq. yds. asphalt macadam pavement with 6-in. stone foundation, 4,289 cu. yds. clay and gravel foundation to John O'Gard, Chicago, Ill., at \$15,004.

SEWERAGE

Sacramento, Cal.—City Commission has passed resolution of intention to construct sewer in 34th St.

Washington, D. C.—American consular officer in Central America reports that contractor in his district desires to get in communication with American manufacturers of machinery for making joint cement drain pipes ranging in size from 5 inches to 1 foot. Quotations for cash or 60 days' credit are desired. Bank references given. (No. 20618.)

Alton, Ill.—City officials have determined to go ahead on plans for big sewer that will drain all territory between Central Ave. and Washington St. Estimated cost of the improvement is \$120,344 and over ten miles of sewer will be laid. Ordinance will be brought up for passage at April meeting of City Council.

Quincy, Ill.—Council will order construction of 10-in. sewer in 14th St.

Hagerstown, Ind.—City has voted in

favor of bond issue in sum of \$750,000 for sewerage system.

Shelbyville, Ind.—Council has ordered the construction of a sewer in Miller St.

South Bend, Ind.—City contemplates pipe sewer in North Frances St.

South Bend, Ind.—See "Streets and Roads."

Muscatine, Ia.—Petition for sewer on Clinton St. and on Bleeker St. was presented to council Mar. 23 and referred to sewer committee with city engineer added. This committee was also instructed to consider proposition of storm water sewer for Locust St. between 5th and 8th Sts.

Patchogue, L. I.—Special election to be held on April 12 has been called by Board of Village Trustees. Two propositions to lay sewer mains and laterals that will be required by sewage system when it is built will be submitted. One for full length of South Ocean Ave., at cost not to exceed \$8,800, and other for Main St. from Bay Ave. to westerly village limits at a cost not to exceed \$5,000. Third proposition calls for improvement of South Ocean Ave. from Division St. to bay at a cost not to exceed \$21,500, and fourth proposition calls for improving full length of Main St. at cost not to exceed \$18,500. Cost of improvements is to be borne by serial bond issue.

Delmar, Md.—Plans completed for joint sewerage system for Delmar, Md., and Delmar, Del., call for expenditure of \$110,000 and steps toward the necessary legislation will be taken.

Boston, Mass.—Council has passed sewer loans, \$600,000 for regular sewer work and \$400,000 for separate system.

Lowell, Mass.—Purchasing Agent Foye has received requisition from street department for 10,000 ft., more or less, of pipe for sewer work. It will be optional with commissioner of streets and highways as to quantity of pipe to be purchased.

Lynn, Mass.—See "Streets & Roads."

Swampscott, Mass.—Citizens have voted in favor of \$20,000 appropriation for construction of eastern trunk sewer.

Flint, Mich.—Resolutions were adopted by Council for construction of storm sewers on North Saginaw St. between Sixth Ave. and Williams St. and also on 5th St. and Lapeer to Avon Sts.

Flint, Mich.—Sewer committee submitted estimates of cost of storm water and sanitary sewers to be constructed this year to Common Council Mar. 29, which totaled \$40,504.77. These estimates cover cost of construction of 13 sewers, which ranged in estimated cost from \$830.66 to \$12,209.86.

Flint, Mich.—Contract for \$196,633.07 sewer bonds have been awarded to First and Old National Bank of Detroit.

Ely, Minn.—Council has rejected all bids for septic tanks and will readvertise.

Little Falls, Minn.—Petition for 12-in. sewer on 2d St. northeast from First to Sixth Ave. was referred Board of Public Works by City Council Mar. 27 for report.

Eveleth, Minn.—City councilmen have decided to construct three blocks of sewer in western part of city, a storm sewer for new cemetery and concrete floor with other repairs in mausoleum.

Las Cruces, N. M.—Bond issue of \$7,000 has been recommended for repair and improvement of sewer system.

Pittman, N. J.—Mayor Justice has approved resolutions adopted by Borough Council for calling of special election to decide upon construction of municipal sewerage system at approximate cost of \$110,000. Legal preliminaries in respect to advertising election and other routine matters will prevent matter coming up for vote for at least three months.

Albany, N. Y.—Ordinance authorizing and directing laying of sewer and appurtenances under west sidewalk of Ontario St. from Bradford St. to Central Ave., will be moved for passage at meeting April 17.

Binghamton, N. Y.—Ordinance has been introduced declaring intention of council to construct sewer on Fayette St. from Sherman Pl to Hawley St.

Brooklyn, N. Y.—Borough President Connolly Mar. 27 opened bids on eight sewer contracts in Queens, to cost \$16,129. Lowest bidder and his figure on each job was as follows: For constructing sewer and appurtenances in Vandam St., from Thomson to Skillman Ave., 1st Ward; Clancy & Van Alst, \$4,694.55. For constructing sewer and appurtenances in Hatch Ave., from Chichester to Beaufort, 4th Ward; Angelo Paimo, \$522. For constructing sewers and appurtenances in Ivy St., from Toledo to Chicago, and in Chicago St., from Ivy to

How did *your* roads come through the winter?

ARE your macadam roads frost-proof? Are they in good condition this Spring? Or are you now going through a season of dirt and mud "while the frost is coming out"? In a typical American township today are these examples of "spring" roads:

Case 1. Old plain macadam

Worn down by automobiles, exposing the uneven basic mosaic which has caught water and suffered severely from disruption by frost. Considerable loose stone. Mud now—dust later. No relief till warm weather when expensive resurfacing will be in order. Deterioration is 40%.

Case 2. New macadam last year

Still a good road but with a one-inch film of mud in wet weather and dust in dry. The smooth "roof" of the road is being destroyed. Already the road fails to shed water promptly, although the foundation is still intact. Deterioration 15%.

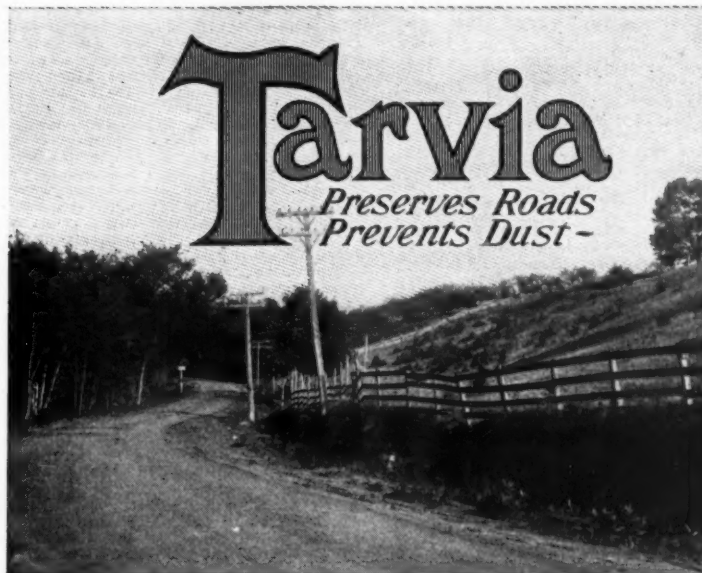
Case 3. Old macadam street treated with oil to suppress dust

Effect of the oiling has worn off. Plenty of dust now, or slimy black mud. Deterioration going on steadily because the oil had no bonding or dust-preventing power—it merely made the dust too heavy to blow. No relief in sight. After mud dries dust must blow till weather is warm enough for re-oiling. Can't even sprinkle with water on account of the old oil.

The foregoing represents the result of old and wasteful methods of road construction. We will now tell you of results where newer and more economical methods were used.

Case 4. Old macadam treated last year with a coat of "Tarvia-B"

Applied from a sprinkling cart, the Tarvia soaked into the surface forming a sort of tough tar-concrete. Sheds water like a duck. No mud or dust. No deterioration. Looks as good as it was last Fall. Needs only light renewals of "Tarvia-B" to make it better than ever.



Note the clean, smooth, dustless Tarvia surface.

Case 5. New macadam built with heavy "Tarvia-X"

Constructed layer by layer three years ago. The Tarvia cements the stone together in a traffic resisting layer. It added slightly to the original cost but saved much stone and labor. Clean, dry and smooth. If it shows any wear a light coat of "Tarvia-B" restores it to prime condition. Tarvia makes macadam frost-proof, winter-proof and automobile-proof. It is a tough, dense, viscid binder, a plastic cement that defies water, weather and traffic.

Expense? Tarvia adds a little at the beginning and saves a lot in the end on the obvious principle that it is cheaper to have a road that will easily withstand modern traffic than to keep on renewing an inferior type of surface that is too weak for the traffic.

A road that pulverizes and abrades under the attrition of the backward kick of the automobile driving-wheels is an expensive nuisance nowadays. That is why the plain macadam road is disappearing.

Durable, dustless tarvia-bonded roads really cost less than dusty, water-bonded macadam roads owing to their longer life and lower maintenance costs.

There is a Tarvia process for most road problems.

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems.

The advice of these men may be had for the asking by anyone interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will have prompt attention.

Illustrated booklet on request.

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Horton, 2d Ward, William J. Horie, \$2,020.84. For constructing sewer and appurtenances in Brandon Ave., from Hamilton to Cedar, 4th Ward: Frank Spinella, \$1,107.85. For constructing sewer and appurtenances in Church St., from St. Ann's to Metropolitan Ave., 2d and 4th Wards: Tony Magliacane and Angelo D'Avine, \$2,616.40. For constructing receiving basin and appurtenances on southeast corner of Hunters Point and East Aves., 1st Ward: Clancy & Van Alst, \$155. For constructing sewers and appurtenances in Anton Ave., from Catalpa Ave. to Silver St., and in Cornelia St., from Anthon to Forest Ave., and receiving basins on the northerly, easterly and westerly corners of Anthon Ave. and Hughes St., 2d Ward: James H. Johnson, \$3,014.42. For constructing sewers and appurtenances in Medina Pl. and Parcel St., to Gerry Ave., and in Gerry Ave., from Chicago to Toledo Sts., 2d Ward: William J. Horie, \$2,002.20.

Niagara Falls, N. Y.—See "Water Supply."

Rochester, N. Y.—See "Streets and Roads."

Syracuse, N. Y.—Ordinance confirming assessment roll and ordering city clerk to advertise for bids for 15-in. sewer in Warner Ave. and other streets has been adopted.

Bowling Green, O.—Ordinance has been passed providing for a lateral sanitary sewer from Prospect and Clough Sts. east to Summit St., thence south to Gould St.

Coshocton, O.—City Council instructed City Engineer Fisher at their meeting Mar. 27 to make preliminary survey and an approximate estimate of costs for enlarging of city's surface water sewer system.

Delaware, O.—Plans being considered for location and construction of new sewage disposal plant.

Lima, O.—See "Streets & Roads."

Lima, O.—Hon. A. L. Methany, Director of Service, has retained firm of George W. Fuller, 170 Broadway, New York City, to make survey, investigation and recommendations relative to sewer relief and sewage disposal for city.

Massillon, O.—Election will be held April 25 to vote on following bond issues: \$2,500 for storm water sewer on State St., \$1,300 for storm water sewer on W. Walnut St., \$6,700 for city's share of constructing trunk sewers on Sippo Valley, \$5,000 for storm water sewer on E. Cherry St.

Niles, O.—City will construct sewers in spring.

Niles, O.—Council will order construction of sanitary sewer in Federal St.

Youngstown, O.—Council has adopted resolution for construction of sewers in Hylda St.

Erie, Pa.—Following suggestions which have been made by B. E. Briggs, city engineer, present council may authorize construction of storm water sewer in territory bounded by 12th St., Chestnut St., Myrtle St. and bay. Estimated cost of sewer is placed at \$30,000.

Lewistown, Pa.—See "Streets and Roads."

Pennsylvania.—Following permits and decrees were issued by Pennsylvania Dept. of Health relative to sewerage during period from March 1st to 31st, 1916: Derry Twp., Eifflin Co. (Highland Park Sewer Co.)—Approving plans for sanitary sewer system. Philadelphia—Approving sewer extensions. Philadelphia—Approving plans for portion of district collecting sewer. Franklin, Cambria Co.—Requiring comprehensive sanitary sewerage plans. East Whiteland Twp., Chester Co. (Villa Maria Academy)—Sewerage and sewage treatment. Taylor Twp., Lawrence Co. (West Pittsburgh Realty Co.)—Requiring treatment of sewage. Berwick—Requiring plans for sewerage and sewage treatment. Chester—Requiring further study of sewage disposal problem. Mount Union—Requiring further study of sewage treatment problem. Norwegian Twp., Schuylkill Co. (Mar Lin Land Co.)—Approving sanitary sewer plans and requiring plans for treatment works. C. A. Emerson, Jr., is Acting Chief Engineer.

Wilkes-Barre, Pa.—Plans for sewer and disposal plant to be erected in Hanover Township will be presented to State Health Department by committee of members selected of board of commissioners. Commissioners Greenwalt and Bohn, together with township solicitor McLaughlin and Township Engineer Boyle were selected at special meeting of commissioners, Mar. 27.

Providence, R. I.—Favorable report was made by House Finance Committee on resolution appropriating \$10,000 to State College for sewage system.

Westerly, R. I.—Special financial town meeting of electors of town will be held in town hall April 6, to take action upon report of water commission regarding proposed sewerage system.

Newport, Tenn.—See "Water Supply."

Amarillo, Tex.—Funds have been received from the recent bond issue for the placing of two miles of additional street paving and of four miles of sewer mains.

Clarksville, Tex.—Henry E. Elrod, Engineer, Dallas, Tex., has been retained by city to prepare plans for reconstruction of sewage disposal plant.

Houston, Tex.—City will let bids shortly upon activated sludge plant. For particulars apply to E. Sands, City Engineer.

Ogden, Utah.—City commission have authorized Joseph M. Tracy, city engineer to obtain accurate survey of Third municipal ward, embracing territory north of Ogden River, with a view of proceeding with construction of sewer system for that district.

Superior, Wis.—City will vote April 4th on bond issue of \$100,000 for creating revolving fund for sewer construction and paving.

CONTRACTS AWARDED.

Long Beach, Cal.—For constructing

clay pipe sewer laterals in District No. 1, approximately 20,370 ft. 8-in. pipe, to Peter S. Tomich, 311 North Hill St., at \$11,970.

Macon, Ga.—For Pineville Branch storm sewer, to Turner & Maugham Co., Cotton Ave., Macon, Ga., at \$25,738. Work includes about 4,000 ft. of 6-ft. to 10-ft. sewer, concrete and segment block. J. J. Gaillard is city engineer.

Greenview, Ill.—To W. D. Duvalet, Greenview, Ill., at \$4,533 for construction of drainage ditch for reclamation of about 200 acres of land along Pike Creek.

Crawfordsville, Ind.—By Board of Public Works for lateral sewer to D. Y. Stout. J. A. Cragwell is City Engr.

Keota, Ia.—To D. E. Keller Co., Davenport, for constructing about 1½ miles of sewers.

Newton, Kan.—Contract awarded to A. Jakcs Construction Co. for constructing storm sewer.

Lexington, Ky.—Ordinance authorizing Mayor to enter into contract with Lexington Hydraulic & Manufacturing Co. for construction of 6-in. water main, with 4-in. branch, to site of proposed sewage disposal plant, was given its second reading and passed Mar. 27, as was ordinance accepting bid of Congleton Construction Co. for building of an 8-in. sanitary sewer on North Limestone from Main to 3rd St.

Inwood, L. I.—Board of Supervisors of Nassau County have given to Charles H. Parks of Inwood contract to lay storm sewer for carrying off surface water along Bayview Ave., Inwood, from Lord Ave. to Sheridan Boulevard, to city line at Far Rockaway. In all there will be laid 2,700 ft. of 18-in. pipe, 900 ft. of 15-in. pipe, 550 ft. of 12-in. pipe, 17 catch basins and 2 manholes.

Mankato, Minn.—For sewers in North 5th, Rock and other streets, to T. K. Coughlan at estimated cost of \$7,000. F. W. Bates is City Clk.

St. Paul, Minn.—Council has awarded contract for construction of Capitol Ave. Sewer System, to O'Neil & Preston, at bid of \$96,000. Engineer's estimate, \$95,496.

St. Paul, Minn.—See "Streets & Roads."

Elmira, N. Y.—To William R. Compton Realty & Building Co., Elmira, at \$16,250, for construction of sewer.

Cleveland, O.—For sewer in Jennings Ave. to C. W. Jackson, Cleveland, at \$11,877.

Shaker Heights (Cleveland P. O.), O.—For storm and sanitary sewers in various streets to Lanese Co., Columbia Bldg.

Erie, Pa.—Contracts for two sanitary sewers on east side were awarded by council Mar. 27. Joseph McCormick and Brothers were awarded contract for 9-in. sewer in 30th St. from Raspberry St. 540 ft. east at their bid of \$710.60, and F. G. Diefendorf for a sewer in 28th St. from German to Parade Sts. at \$781.60. Engineer's estimate for the first sewer was \$1,100 and for the second 1,200.

Walla Walla, Wash.—Following bids were received Mar. 21 for sewer extension in Local Improvement District No. 165:

Contractor.	15-in. Sewer	12-in. Sewer	10-in. Sewer	8-in. Sewer	6-in. Sewer	Manholes
The G. H. Sutherland Co.....	2090 lin. feet @ \$1.34 Amt. \$2,800	358 lin. feet @ \$0.86 Amt. \$307.88	1040 lin. feet @ \$0.81 Amt. \$842.40	2135 lin. feet @ \$0.70 Amt. \$1,494.50	2700 lin. feet @ \$0.60 Amt. \$1,620.00	20 @ \$45.00 Amt. \$900.00
Wood and DeCamp.....	@ \$1.20 \$2,508.00	@ \$0.89 \$318.62	@ \$0.70 \$728.00	@ \$0.59 \$1,259.65	@ \$0.41 \$1,107.00	@ \$40.00 \$800.00
The H. L. Wilson Co.....	@ \$1.07 \$2,236.30	@ \$0.90 \$322.20	@ \$0.82 \$852.80	@ \$0.70 \$1,494.50	@ \$0.60 \$162.00	@ \$45.00 \$900.00
O'Rourke Bros.	@ \$1.11 \$2,319.90	@ \$0.92 \$329.36	@ \$0.81 \$842.40	@ \$0.68 \$1,451.80	@ \$0.58 \$1,566.00	@ \$40.00 \$800.00
Pacific S. & W. Construction Co....	@ \$1.30 \$2,717.00	@ \$0.85 \$304.30	@ \$0.75 \$780.00	@ \$0.65 \$1,387.75	@ \$0.50 \$1,350.00	@ \$48.00 \$960.00
Geo. Gordon Co.....	@ \$1.35	@ \$1.00	@ \$0.80	@ \$0.70	@ \$0.50	@ \$50.00

Contractor.	15-in. Y's	12-in. Y's	10-in. Y's	8-in. Y's	6-in. Y's	Totals
The G. H. Sutherland Co.....	25 @ \$1.25 Amt. \$31.25	8 @ \$1.00 Amt. \$8.00	33 @ \$0.70 Amt. \$23.10	87 @ \$0.65 Amt. \$56.55	75 @ \$0.45 Amt. \$33.75	Amt. \$8,118.03
Wood and DeCamp.....	@ \$2.90 \$72.50	@ \$1.98 \$15.84	@ \$1.58 \$52.14	@ \$1.08 \$93.96	@ \$0.72 \$54.00	\$7,009.71
The H. L. Wilson Co.....	@ \$1.25 \$31.25	@ \$0.80 \$6.40	@ \$0.65 \$21.45	@ \$0.60 \$52.20	@ \$0.35 \$26.25	\$7,563.35
O'Rourke Bros.	@ \$1.25 \$31.25	@ \$0.81 \$6.48	@ \$0.60 \$19.80	@ \$0.52 \$45.24	@ \$0.33 \$24.75	\$7,436.98
Pacific S. & W. Construction Co....	@ \$3.50 \$87.50	@ \$2.50 \$20.00	@ \$2.00 \$66.00	@ \$1.75 \$152.25	@ \$1.25 \$93.75	\$7,918.55
Geo. Gordon Co.....	@ \$2.00	@ \$2.00	@ \$1.00	@ \$1.00	@ \$1.00	\$8,116.00

W. R. Rehorn is City Engineer.



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6-FOOT SIZE BUILT FOR LONG
HAULS OVER BAD ROADS.

**ASK ABOUT
11 FT.
STEAM PAVER**
A Great Low Priced Paver.

Houston, Tex.—For constructing storm sewer in Hill St., to H. M. Miller, Houston, at \$51,382.

Kohler, Wis.—For 1,100 ft. 8-in. sanitary sewer to D. Van Stelle Co., Mayville, Wis. W. W. Loeder is City Clerk.

WATER SUPPLY.

Los Angeles, Cal.—Voters of section of San Fernando valley known as Mission district, or water works improvement district No. 2, will vote on bond issue of \$300,000 for distributing system for aqueduct water.

Boulder, Colo.—Water Commissioner Tom Barry put a force of men to work constructing 35-ft. extension of 4-inch water main on Pearl St., east of 26th St.

Platteville, Colo.—Pumping plant for Platteville's new water works system was purchased Mar. 25. Work has been begun on new pump house of concrete and pressed brick to cost \$22,000. Water is to be pumped from an artesian well drilled to depth of 850 feet.

Wilmington, Del.—Board of Water Commissioners has retained firm of Geo. W. Fuller, 170 Broadway, New York City, to prepare plans and specifications for 12-million gallon rapid sand filter plant, and also for covered filtered-water reservoir to be located in city on Rodney St. It is expected that bids for the filter plant will be received on May 8, with plans and specifications available about April 24 as per formal notices to be announced later.

Pensacola, Fla.—According to plans which were submitted Mar. 27 by Superintendent J. L. Sweeney of city water department, it will be necessary to lay total of 8,075 feet of 6-in. piping to assure fire protection for plant of the Newport Tar and Turpentine property, now in course of construction in Maxent tract. Total cost of this work, as was given by superintendent, was \$5,744. To lay this piping, however, charge of 71 cents per foot was bid by one firm. It will require 132 tons of piping, to start with, which will cost, according to present quotations, \$3,960. There will be ten or eleven hydrants installed, and seven to ten valves.

Athens, Ga.—Mayor and council Mar. 23 unanimously passed ordinance calling an election for April 29 on question of issuance of \$40,000 in bonds for extending, enlarging, and otherwise improving water works system of city.

Elmhurst, Ill.—Following bids were received for 90,000-gallon elevated tank: Memphis Steel Const. Co., \$6,499 (bid irregular); Des Moines Bridge & Iron Co., \$6,800; Chicago Bridge & Iron Co., \$5,800 and \$6,600. Address H. L. Emerson, 133 W. Washington St., Chicago, Ill.

Peoria, Ill.—Communication asking for passage of ordinance to compel the Peoria Water Works Co. to lay water main on Richmond Ave. prior to paving of said street was referred to committee on water works and corporation counsel.

Waukegan, Ill.—City planning to improve water system. Resolution has been passed for 24-in. water main leading from waterworks and connecting with other large mains.

Emporia, Kan.—Water works bonds, recently voted by city, have been approved by attorneys for successful bidders, A. B. Leach & Co., Chicago, Ill., for \$75,000 worth of the \$150,000 voted.

Lafayette, La.—See "Miscellaneous."

New Orleans, La.—John Riess was lowest bidder on Contract 67D of Sewerage and Water Board bids. Contract is for extensions of pumping station No. 3, at London Ave. and Marigny St., to install two of the mammoth Wood lift pumps. Bids were John Riess, \$60,365; Hampton Reynolds, \$68,400; R. McCarthy, Jr., \$74,112; Black & Laird, \$68,850.

Shreveport, La.—John B. Hawley of Fort Worth, Texas, has been chosen to design and supervise construction of new municipally owned water and sewer system of Shreveport, La. He was chosen from among eighteen of leading hydraulic engineers of United States who were considered for the place. New system will cost \$1,200,000.

Augusta, Me.—York County Water Co. wishes to sell bonds in sum of \$30,500 for installing filter plant and other improvements.

Tacoma Park, Md. (P. O. Washington, D. C.)—Special election of quality taxpayers of town will be held Monday,

April 3, in basement of Takoma Presbyterian Church, to vote on proposed bond issue of \$25,000 for construction of reservoir and extension of present water system of town. The judges of election will be L. M. Mooers, F. W. Longley and S. H. Kyle.

Fall River, Mass.—Water Board has decided that three lowest bidders for pumping station improvements shall confer with Mr. Barrows and clerk of board. It is understood that bids submitted are very much in excess of estimates prepared by engineer, who was confident that work could be done for a great deal less money than that proposed. Bidders will have an opportunity of going over Mr. Barrow's estimate of material and prices, and it is expected that new proposals can be made which board will find itself able to accept.

Gloucester, Mass.—Municipal council meeting received bids for water loan of \$30,000, payable \$1,000 each year for 30 years, at 4 per cent. interest, which were laid on table for one week. The loan will be awarded to Cape Ann National Bank at their bid of 102.315 per cent. or \$1,023.15 for each \$1,000, their bid being highest.

Wenham, Mass.—Legislature has passed bill to authorize the town of Wenham to supply itself and its inhabitants with water. Any supply within the town limits may be taken which has not already been taken by Salem or Beverly, and \$100,000 in bonds may be issued.

Duluth, Minn.—Gas and water extensions have been ordered in Piedmont Ave., from Forrest Ave. to Bay View Terrace.

New Ulm, Minn.—Following bids were opened March 20th for new Deepwell Pump-head and repair of old one: Union Mach. Co., St. Paul, new pump-head, \$5,724; repairing of old pump-head, \$1,139; J. G. Robertson Co., St. Paul, \$5,000, \$837; Muir Engr. Co., St. Paul, \$5,025, \$1,187. All bids rejected. Prices high by 30%. City will make repairs on old head itself. F. D. Minium is City Engineer.

Las Cruces, N. M.—Bond issue in sum of \$13,000 has been recommended for repair, improvement and extension of water works system.

Atlantic City, N. J.—Plans and specifications for labor attendant upon laying of high pressure main were received Mar. 24 from Superintendent Van Gilder and Commissioner Bachrach, and approved. Bids will be received early in April.

Batavia, N. Y.—Great advances, amounting to fully 100 per cent. in building material on account of European war may defeat, or at least cause postponement in installation of Batavia's pure water system and filtration plant. Bids on work, for which taxpayers voted an appropriation of \$175,000 last fall, have been opened and are found to be all far in excess of this estimate. Forty-nine different contracting firms entered great variety of bids and lowest of these aggregated between \$195,000 and \$200,000 for entire contract. Common council is discussing proposition to hold another special election at which taxpayers will be asked to vote for additional appropriation of upwards of \$25,000.

Dunkirk, N. Y.—City will probably spend \$6,000 in extending and replacing water mains during the summer.

New York, N. Y.—Board of Water Supply will call for bids for 5 miles of reinforced concrete fenders for roads around Kensico reservoir. Percy C. Barney is First Assistant Engineer.

Niagara Falls, N. Y.—City Engineer Bennett reported to the city council at meeting Mar. 27 that it will cost \$25,250 for new water main in Main St. from Pine to Ontario Ave., city to furnish pipe, connections and valves. Engineer estimated cost of piping, connections and valves, which will be furnished by city at \$12,800. Engineer also reported cost of a sewer in alley on west side of the city market would be \$1,775. Sewer is needed to drain market site. Engineer and city manager were directed by council to advertise for bids for improvements.

Yonkers, N. Y.—Spending of \$1,200 for repair of Worthington pump at low service station was authorized last night by common council.

Yonkers, N. Y.—City has sold bonds \$100,000 will be applied to water purposes.

Hamilton, O.—Members of finance committee of city council, meeting in closed session Mar. 27 decided to recommend issuing of \$125,000 to \$150,000 in bonds for improvements in many city departments. Members of committee refused to discuss proposed bond issue, but it was authoritatively stated that popular vote on bond issue would be taken at November election. Such recommendation will be made to city council at its next meeting. It is known that about \$65,000 in bonds will be issued for improvements at city gas, electric and water plants. Another \$25,000 or \$35,000 will be issued to improve conditions in fire department, and probably for construction of new house on the West Side. There will be cut in amount asked by safety director for fire department, and it is probable that only part of companies now using horses will be motorized. Another issue will be for improvement of roadways leading into Hamilton.

Lima, O.—Installation of purification plant for water works has been urged by E. F. McCampbell, secretary of state health board.

Lima, O.—See "Streets and Roads."

Piqua, O.—Citizens will decide at the primaries Aug. 8, whether they desire to bond the city for \$150,000 with which to secure a better, purer and more sanitary water supply.

Youngstown, O.—Superintendent John S. Lewis, of water works department, will shortly advertise for bids on two 15,000,000 electrically driven centrifugal pumps for filter bed water supply and one 4,000,000 gallon pump for water wash. Latter pump will furnish water to wash filtering basins.

Wellston, Okla.—Board of Trustees of Wellston, Okla., will receive bids up to 7:30 p. m., Apr. 17, 1916, for furnishing of all labor, tools and materials for construction of waterworks as per plans and specifications prepared by Benham Engineering Co., 13th floor Colcord Bldg., Oklahoma City, Okla., who are engineers for town. Work will consist of following: 6-in. cast iron pipe, 4,960 lin. ft.; 14-in. cast iron pipe, 5,600 lin. ft.; and 2-in. wrought iron pipe, 4,560 lin. ft.; special castings, 7,000 lbs.; 2-in. crosses, 150; fire hydrants, 22; water crane hydrants, 1; 6-in. gate valves and boxes, 2; 4-in. gate valves and boxes, 9; 22 gate valves and boxes, 10; 30,000-gal. elevated tank; 1 7½-h. p. and 1 25-h. p. gas engine; 100 G. P. M. centrifugal pump; 1 250 G. P. M. horizontal duplex pump; alternate bid for air compressor; receivers, etc.; power house building and 100,000-gal. surface brick reservoir. Complete plans and specifications can be procured upon payment of \$5 at office of engineers.

Florence, Ore.—Bids were received on driving wells for city water system at meeting of the council Mar. 22, but these were rejected and work will be done by day labor under direction of City Engineer Ford.

Hazleton, Pa.—Official announcement was made here Mar. 27 by Lehigh Valley Coal Co. that nothing has yet been done toward awarding contract for running of big tunnel from Hazleton basin through Butler Mountain to Nescopeck Creek. It is expected that after negotiations between miners and operators on new agreement are concluded tunnel project, involving an estimated expenditure of \$100,000, will be taken up. It will mean saving of thousands of dollars annually now spent for pumping water out of collieries.

Pennsylvania.—Among permits and decrees issued by Pennsylvania Department of Health relative to waterworks during the period from Mar. 1 to 31, 1916, inclusive, were following: Jonestown (Lebanon Valley Consolidated Water Supply Co.)—Approving plans for filtration plant improvement and extensions to distributing system. Shenandoah (Shenandoah Citizens' Water and Gas Co.)—Approving additional drilled well supply. Mount Pleasant (Mount Pleasant Water Co.)—Approving extensions to distributing system and requiring plans for filtration. Ross Twp., Luzerne Co. (Sweet Valley Water Co.)—Approving new system and drilled well supply. Pine Grove—Approving new intake. Wellsboro (Wellsboro Water Co.)

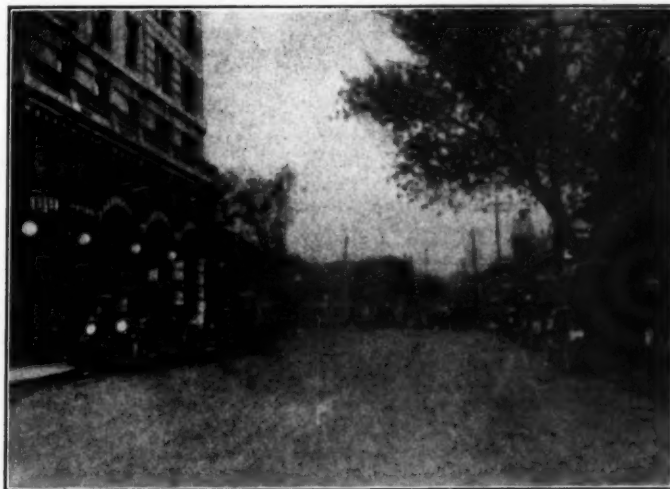
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—Approving changes at reservoir and requiring report on improvement of system. West Grove—approving new supply and filtration plans. C. A. Emerson, Jr., is Acting Chief Engineer.

Orangeburg, S. C.—City council has awarded several contracts for work and material in building of new water and light plant, on site near Edisto River. Excavating is now being done and erection of plant will begin in a short time.

Newport, Tenn.—The \$25,000 corporation bonds have been sold. The proceeds of the issue will be used to pay a floating debt of \$10,000, which was incurred for sidewalks and other improvements, for water and sewer extensions to cost \$5,000, for further street improvements of \$5,000, and \$5,000 will be used for an electric light system for the town, which will include a white way along the main street. Work on these improvements will begin at once, and will be rushed to completion.

Galveston, Tex.—M. E. Shay, city water and sewer commissioner, has been granted authority to purchase not to exceed 1,000 ft. of additional pipe for new underground submerged water main now in course of construction across Galveston Bay.

Galveston, Tex.—Bids to supply engines and electrical equipment for two new wells at Alta Loma were opened Mar. 24. Bids were of such form that their relative amounts could be estimated only by tabulation. Bidders were Allis-Chalmers Co., the Muncie Oil Engine Co., Southern Engine and Pump Co., York Engineering & Supply Co., and A. M. Lockett Co. Bids were referred to Commissioner Shay and committee of advisory engineers which has been assisting city officials in improving city water department.

Henrietta, Texas.—City will extend its water mains and increase the efficiency of the water system in the matter of fire protection.

Wheeling, W. Va.—Ordinance introduced authorizing director of public service to expend amount not to exceed \$1,200 for replacing and rebuilding stacks at water works pumping station. Ordinance was passed under suspension of rules, after lengthy discussion.

CONTRACTS AWARDED.

Audubon, Ia.—For extension of water mains, hydrants, etc., to Ward & Weigh-ton, local, at \$14,193.30. Other bidders were as follows: Donnegan & Briggs, Shenandoah, \$14,723.21; Roland Construction Co., Des Moines, \$15,095.80; Katz Construction Co., Omaha, \$15,478.50; Elk Horn Construction Co., Fremont, Neb., \$15,846.60; Morrison Construction Co., Des Moines, \$19,097.80.

Elkhart, Kan.—For water system as follows: General contract to Alamo Engine & Supply Co., Omaha, Neb., at \$12,365; stand pipe to Chicago Bridge & Iron Works, Chicago, Ill., at \$3,500; well to B. Smith, Elkhart, at \$802; fire-fighting equipment to Eureka Hose Co., Kansas City, Mo. W. B. Rollins & Co., Midland Bldg., Kansas City, Mo., is Engr.

Emporia, Kans.—City commissioners have awarded contracts for waterworks equipment as follows: General contract which includes filter house, basins, booster station and pipe lines to Middleton & Ludlow, Kansas City, at \$65,792.49. Other bidders were: McCoy & Taylor, Emporia, \$70,534.78; F. D. Martin, Kansas City, \$73,132.55; Koehler Construction Co., Kansas City, \$74,281.00; Kansas Paving & Construction Co., Kansas City, \$74,998.58; Edward Jones, Leavenworth, \$78,146.70. Valve contract to Merkle Hines Machinery Co., at \$3,012.08. Other bidders were: Kennedy Valve Manufacturing Co., \$3,334.25; Jones Foundry Co., Emporia, \$3,334.25; Ludlow Valve Co., \$3,530.74. Contract for pumps to Henry R. Worthington, Kansas City, at \$8,200. Other bidders were: Reeves & Skinner, at \$8,090; American Well Works, \$8,498.00; Gould Mfg. Co., \$8,682.00; Thermal Efficiency Co., \$9,000.00; Merkle Hines Co., \$9,400.00. Tank and tower contract to Des Moines Bridge and Iron Co., at \$4,485. Other bidders were: Chicago Building and Iron Works, \$5,000; Memphis Steel & Construction Co., of Greensburg, Pa., \$5,454. For filtration equipment to New York Continental Jewell Filtration Co., of Kansas City and New York City, at \$12,972, and \$13,395. Each bidder made two bids on contract for water filtration equipment; the first sum here given after

each name is in case hypochloride of lime is used as disinfectant, and second amount where liquid chlorine is utilized: American Water Softening Co., of Philadelphia, \$12,223, \$12,807; Roberts Filter Mfg. Co., of Chicago, \$12,850, \$13,150; International Filter Co., of Chicago, \$13,188, \$13,588; Pittsburgh Filter Mfg. Co., of Pittsburgh and Kansas City, \$14,873, \$15,479; National Water Purifying Co., of Dallas, Texas, \$17,675, \$17,975.

Lexington, Ky.—See "Sewerage—Contracts Awarded."

Attleboro, Mass.—Contract for furnishing tools to water and highway departments of city was awarded by Supt. H. J. Goodale to William F. Flynn & Son, 33 Park St., of this city. Bid submitted by this firm was lowest.

Boston, Mass.—To Gibney Foundry Co., at 2.475 cts. per lb., for 650,000 lbs. iron castings, and to Hersey Mfg. Co., 1st St., South Boston, for 5,675 $\frac{1}{2}$, 1, 1 $\frac{1}{2}$ and 3-in. water meters at a total cost of \$34,354, and to Mechanics Iron Foundry Co., 38 Kemble St., Roxbury, for 450,000 lbs. No. 1 iron castings for water service of public works department at 2.35 cts. per lb.; total, \$10,575.

Easthampton, Mass.—By board of public works, for following: Sewer pipe and w. i. pipe, to C. C. Coates, of Easthampton; lead, Richards & Co., Boston; c. i. water pipe, Warren Co., New York.

Kalamazoo, Mich.—The Wheeler-Blaney Co., as the lowest bidder, have been awarded contract for supplying city with 500 curb cocks for use in the meter department. Other bidders were the Hayes Manufacturing Co. of Chicago, Bond Supply Co. and the A. Y. McDonald Manufacturing Co. of Dubuque, Ia. water works were opened Mar. 27 and awards made as follows: 75,000 gal. tank and tower to Pittsburgh-Des Moines Steel Co., Dallas, Tex.; pumping machinery, 100 G. P. M. deep well pump, driven by 20-hp. Little Giant oil engine, to Gamar Co., Fort Worth, Tex. Distribution system, 6 and 8-in. cast-iron pipe, Class B, to Hamilton Bros. Construction Co., Houston, Tex. Henry E. Elrod, Dallas, Tex., is engineer.

St. Paul, Minn.—See "Streets & Roads."

St. Paul, Minn.—To Badger Meter Company for furnishing city with water meters, from $\frac{1}{2}$ -in. to 1 $\frac{1}{4}$ -in., inclusive, for 1916 requirements.

Jamestown, N. Y.—For 159 tons 6-in. c. i. bell and spigot pipe and 5 tons special castings to J. B. Clow & Sons, Chicago, Ill., at \$28.50 per ton for pipe and \$0.03 per pound for castings.

Rochester, N. Y.—Contract for five tons of lead pipe for Waterworks Bureau was let to Rochester Lead Works for 9 $\frac{1}{2}$ cts. a pound. R. D. Wood & Co. will furnish hydrants for season for \$1,818.

Pauls Valley, Okla.—City council has recently sold \$1,000 worth of bonds which were voted for purpose of drilling wells to furnish city water. Council let contract to Layne & Bowler, of Houston, Tex., to begin work on wells within ten days. Wells are to be one-half mile northeast of Pauls Valley and water is to be pumped by electricity to reservoir through an eight-inch flow line. Contractors guarantee to furnish 25,000 gals. of water daily.

North Wales, Pa.—For erecting water tank by North Wales Water Co., to Tibbet & Ward Co., of Phillipsburg, N. J., at \$2,700.

Nashville, Tenn.—For 900 Empire water meters to National Meter Company.

Dallas, Tex.—Board awarded contract for furnishing water department with ninety tons of cast iron pipe to Lynchburg Foundry Co., of Birmingham at its bid of \$29.20 per ton.

Kohler, Wis.—For 1,100 ft. 6-in. water mains to D. Van Steele Co., Mayville, Wis. W. W. Loeder is Village Clerk.

MISCELLANEOUS.

Tucson, Ariz.—Protests against awarding contract for erection of new city hall have been filed with city clerk and city council by Tucson Central Trades Council. No decision has been announced by city authorities. Protest is based on total figures of bids. It points out that lowest bid submitted, as shown at meeting of city council recently was for \$47,520, or \$2,520 more than was originally set aside by council for construction of building. The other four bids were

above \$50,000, total bondage for structure.

San Francisco, Cal.—Municipal Railway line on Potrero Ave. is to be extended from 25th to Army St., distance of one block, and City Engineer has requested Supervisors to provide for having tracks laid concurrently with street work that is to be done in extending Potrero Ave. from 25th St. to San Bruno Ave. For extension of Potrero Ave. an exchange of lands was made between city and Ocean Shore Railroad Co.

Rocky Ford, Col.—City Council decided to start at once on construction of new city hall.

Washington, D. C.—Business man in Africa has informed American consular officer that he desires to represent American manufacturers and exporters of low-priced automobiles, light motor trucks, and agricultural machinery. He wishes to secure agency on a commission basis. It is stated that cash will be paid against bill of lading at port of destination. Name of bank through which document may be sent has been transmitted. Correspondence is preferred in Portuguese, but English or French may be used. (No. 20629.)

Washington, D. C.—Sealed proposals will be received by Lighthouse Inspector, Portland, Me., until April 10, 1916, for furnishing and delivering two kerosene burning oil engines with air compressors. Further information may be obtained on application to Lighthouse Inspector, Portland.

Washington, D. C.—Sealed proposals will be received by Lighthouse Inspector, Tompkinsville, N. Y., until April 7, 1916, for furnishing and delivering to General Lighthouse Depot, Tompkinsville, N. Y., 20,000 pounds of red lead. Further information may be obtained on application to Lighthouse Inspector, Tompkinsville.

Washington, D. C.—Commercial attaché of Department of Commerce in England reports that man in that country desires to be placed in touch with American manufacturers of portable machines for making concrete building blocks up to 32 by 16 by 9 inches. (No. 20575.)

Fort Wayne, Ind.—Ordinance ratifying contract and specifying that garbage plant is to be constructed on city dump on Barr street was passed Mar. 28.

Kokomo, Ind.—Board of works at meeting Mar. 27 indicated that they intended to go through with proposed plan for straightening, widening and deepening of Wildcat Creek. Members of board indicated that they are in earnest on proposition, and after meeting said that work would probably be ordered April 3.

Richmond, Ind.—Columbus, Greensburg & Richmond Traction Co., which was incorporated about 10 years ago, will probably be reorganized and efforts made to secure finances sufficient to construct road, according to officials living in Indianapolis. Walter McConaha of Richmond, is one of the directors of the company. John A. Shafer, civil engineer, of Indianapolis, is working on revived plans, August M. Fuhn of Indianapolis, is president of road. Ten years ago right of way had been purchased, but leases have expired. Due to the stringency of money market ten years ago, promoters were unable to go ahead with plans. Proposed road will cost approximately \$3,000,000 and will be eighty-four miles in length. According to officials of road both New York and Philadelphia bonding houses are ready to get behind proposition.

La Fayette, La.—City Council of Lafayette has ordered special election May 2 on question of incurring an indebtedness of \$100,000 for purpose of making following improvements: \$20,000 for fire protection and alarm system; \$30,000 for improvements and extending water mains; \$25,000 for a white school; \$10,000 for a negro school; \$15,000 for public park. Bonds to be issued are to run forty years with 5 per cent interest. Chicago capitalists have arranged to take up entire issue.

Augusta, Me.—Police signal system boxes will be installed shortly.

Annapolis, Md.—See "Streets & Roads."

Boston, Mass.—Orders aggregating \$200,000 for playgrounds were passed by City Council at regular session Mar. 27. An order for \$149,000 was deemed adequate to complete work at Savin Hill playground. Other loans were \$25,000 for North End Park and pier and for Parker Hill playground.

Brookline, Mass.—At adjourned town meeting Mar. 28 it was voted to appro-

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appropriate \$3,500 for improvements in old tuberculosis hospital building, so that it may be used for a smallpox ward; to appropriate \$15,600 for improving municipal bathhouse.

Holyoke, Mass.—Plans are being discussed for improvement of city playgrounds. Commission's appropriation for maintenance is \$10,000, a little more than \$1,000 less than the estimate. Commission has in mind securing of funds for improvements through bond issue.

Pittsfield, Mass.—See "Streets and Roads."

Wyandotte, Mich.—Wyandotte women are campaigning for purchase of old J. H. Bishop fur factory site by city for use as park. Taxpayers will vote April 3 on proposal for bond for \$40,000 to buy property.

Chisholm, Minn.—See "Streets and Roads."

Bay St. Louis, Miss.—A 13-ft. seawall, about three miles in length, will be reported to board of mayor and aldermen, accompanied by resolution, and it will then be up to that body to proceed to promulgate its intention of issuing about \$200,000 in bonds to defray cost of building wall and filling behind in order to restore front street.

Kansas City, Mo.—One and one-half million dollars will be expended on Kansas side for public improvements during this year, most of it by various county and city boards. If proposed franchise to the Kansas City Terminal Co. is voted amount expended will be increased 4 million dollars, as terminal then will spend that sum in stations, an overhead structure of steel, a double-deck Kaw River bridge and other terminal facilities. Of the amount to be expended by terminal company, about one-half million is for viaduct and subways. The following shows how money will be expended: Wyandotte County Commissioners—Central Avenue bridge and traffic way, \$600,000; cleaning Kaw River channel, \$22,000; improving roads, \$45,000; county total, \$667,000. Drainage Board—Raising dikes and cleaning river, \$175,000; city commissioners—streets, sewers, alleys, \$225,000; parks, \$75,000; total of governmental boards, \$1,142,000. The money to be expended for public improvements by other interests includes the following: Kansas City Southern Railway, for new bridge, \$400,000; railway subway at Adams and Shawnee, \$75,000; railway portion of Eighteenth St. viaduct, \$40,000; total, \$515,000.

Newark, N. J.—Mayor has approved plans for new police headquarters.

New Brunswick, N. J.—City fathers favor purchase of Cogswell property for city hall at expense of \$31,000.

Binghamton, N. Y.—If arrangements can be made police ambulance, which was provided for in 1914-15 budget and purchased by last administration will be sold or exchanged for touring car.

Buffalo, N. Y.—Councilmen have decided to buy about 190 new voting machines. They will cost approximately \$90,000. This includes credit of \$30,000 for the old machines in exchange. Election commissioners will probably send communication to the council recommending exchange. Recommendation will be adopted.

Medina, N. Y.—Town has voted to purchase Chamberlain property for \$11,000 for park.

Penn Yan, N. Y.—Village has voted in favor of raising \$300 for band concerts during the summer.

Rochester, N. Y.—Clerk Pifer has been instructed to advertise for bids for street sprinkling for the season, estimated cost of which is about \$95,000. Bids will also be asked for furnishing coal for city buildings for season.

Rome, N. Y.—Rome's \$40,000 of five per cent bonds sold Thursday night for the best price obtained in recent years. They brought par, accrued interest from date of issue until date of delivery and a premium of \$3,712.25, a total of \$43,712.25. The purchasers were Robinson, Humphrey Wardlaw Co., of Atlanta, the high bidder, out of eight competing firms. In addition to the premium paid, the successful bidders will prepare the bonds, ready for signature—an additional saving to the city of about \$150. Other bidders were as follows: Stacy & Braun, Toledo, \$3,578; Jno. W. Dickey, Augusta, \$3,272; Sidney Spitzler Company, New York, \$3,100; W. M. Davis Co., Atlanta, \$2,604; Cumming, Prudden Co., New York, \$2,144; Seasongood and Mayer, Cincinnati, \$2,052.

Schenectady, N. Y.—Extensive improvements, anticipating increased efficiency of garbage reduction plant, are planned.

Schenectady, N. Y.—The board of contract and supply will open bids next week for a run-about automobile for the bureau of streets and sewers, department of public works. The following week bids are to be received for a conveyor to be erected at the garbage reduction plant.

Cleveland, O.—Bids for bond issue in sum of \$425,000 for sinking fund commission will be received at office of sinking fund commission, room 507, City Hall, Cleveland, O., until 12 o'clock noon, April 10. C. J. Neal is secretary. No bids will be entertained unless made on blank form furnished on application.

Relly, O.—Board of Education has passed resolution to issue bonds in sum of \$30,000 to obtain money to build school house. Election will be held April 5 to permit voters of Township to vote on issuing of bonds.

Toledo, O.—Toledo will have new \$11,500 park and children's playground, if action taken by city council's public improvements committee Mar. 22 is approved by council.

Tulsa, Okla.—Sewer bond issue of \$100,000 has been approved and entire issue will now be available for immediate sale. Attorney General Freeling, however has not yet approved bond issue for city hall purposes or park extensions and improvements.

Harrisburg, Pa.—Plans are now being made by Commissioner Gross and his assistant, V. Grant Forrer, for opening of park season, according to an announcement made at park office Mar. 27. During the season extensive improvements will be made including concrete culverts in Wildwood Park, subway beneath the tracks of the Philadelphia & Reading railroad near Paxtang Park, large cinder path in Wildwood and numerous other improvements. Concrete culvert will be erected at northern end of Wildwood and it will replace old wooden bridge while subway will be erected at place where parkway will be cut under railroad tracks. It is estimated that this subway will cost between \$15,000 and \$17,000, and it may be possible that railroad company will stand part of its cost. Cinder path will be constructed along the Wildwood Lake between Fox's run and the Linglestown road, and it will be about 1,300 ft. in length.

New Castle, Pa.—That New Castle will be bonded to an amount ranging from \$150,000 to \$175,000 for improvements which are to be made in city during the coming year is conceded to be highly probable, as sentiment expressed at special meeting of council held Mar. 31 was very favorable to proposition.

South Bethlehem, Pa.—Council passed on final reading ordinance providing for collection, removal and disposal of garbage, rubbish, and ashes. Ordinance was referred to officials for signatures and secretary was notified to advertise for bids for collection of garbage for 1, 2, 3, 4 and 5 years. Contract expires May 1.

Wilkes-Barre, Pa.—Bids for street cleaning work for ensuing year were opened at meeting Mar. 24 of City Council. Three bids were received and they were referred to Superintendent Murray of department of streets, and he will award contract shortly. Three local firms are bidders, as follows: Curnow & Murray, Goeringer & Bands and Harry Cassidy.

Providence, R. I.—Aldermanic committee on health recommends the immediate passage by the City Council of a resolution asking legislative authority for the city to hire \$300,000 for the erection and equipment of a municipal garbage disposal plant.

CONTRACTS AWARDED.

Warsaw, Ind.—Contract for erection new grade school building was awarded to Merle Hodges and A. A. Gast for \$49,000. Building will cost about \$70,000 when completed.

Attleboro, Mass.—Contracts for providing police department with auto patrol and touring car for investigations were awarded Mar. 25. For \$625 and old machine used by department, the city will receive Maxwell auto patrol subject to specifications submitted. If specifications are complied with contract will be carried out. This bid was submitted by C. L. Rogers. George H. Snell was awarded contract for Overland car, model 75, for investigation purposes. Contract is for \$650.

Pittsfield, Mass.—At meeting of city fire department committee Mar. 22, the contract for installing a new system of plumbing in the Central fire station was

awarded to Noble, Milne & Co., lowest of six bidders, price being \$828. Plumbing includes shower baths for use of firemen and new piping to replace old and out-of-date piping. Bids were as follows: M. H. Condron, \$998; W. G. Backus Sons, \$943.97; H. L. Doran & Co., \$900; John H. Retallick, \$890; D. W. Bovett, \$860; Nolan & Hebert, \$840; Noble, Milne & Co., \$828.

Meridian, Miss.—City council has let contract for building of two-story brick stable and single story wagon house to C. B. Snow for sum of \$1,589, city to furnish material. Stable is to have stucco effect. Roof and metal work was awarded to Kirkland & Bradford at \$860.

Atlantic City, N. J.—Contract for supplying Boardwalk lumber for widening improvement in the upper section was awarded to Allen B. Staiger at his low bid of \$13,426.40. Bids of \$13,499.70 from Somers' Lumber Co. and \$13,499.12 from Volney G. Bennett Co., of Camden, were also received.

Long Branch, N. J.—Contract for removing city garbage for the next five years will be executed by Harry T. Blodgett. Mr. Blodgett is head of Seaboard Utilization Co., which holds present contract. He was only bidder before city commissioners yesterday. His bid for removing garbage for next five years is \$59,000. The Seaboard company now receives \$10,000 a year for doing work.

Newark, N. J.—General contract for construction of tunnel under Hackensack River from Public Service dock at Marion power plant in Jersey City to lands recently purchased by Seaboard By-Products Co. on Kearney side of the river opposite has been awarded by Public Service Gas Co., to Arthur McMullen Co. of New York. Tunnel will be circular, of concrete construction, 645 ft. in length and will be built sixty-four feet below low water mark. The inside diameter will be 7 ft. Two shafts, each eight and one-half ft. in diameter, will be erected on each side. The tunnel will cost \$62,500, and under terms of the contract must be completed by next September. Purpose of tunnel, according to the main office of Public Service Corporation, is to carry gas pipes. The Seaboard Co., which will make coke, is under contract with the Public Service Gas Company to furnish it with gas.

Perth Amboy, N. J.—Contract for collecting garbage throughout city for next three years was awarded to Graham & McKeon. Contract price is \$19,500 a year, which is about \$12,000 more than is paid under existing contract.

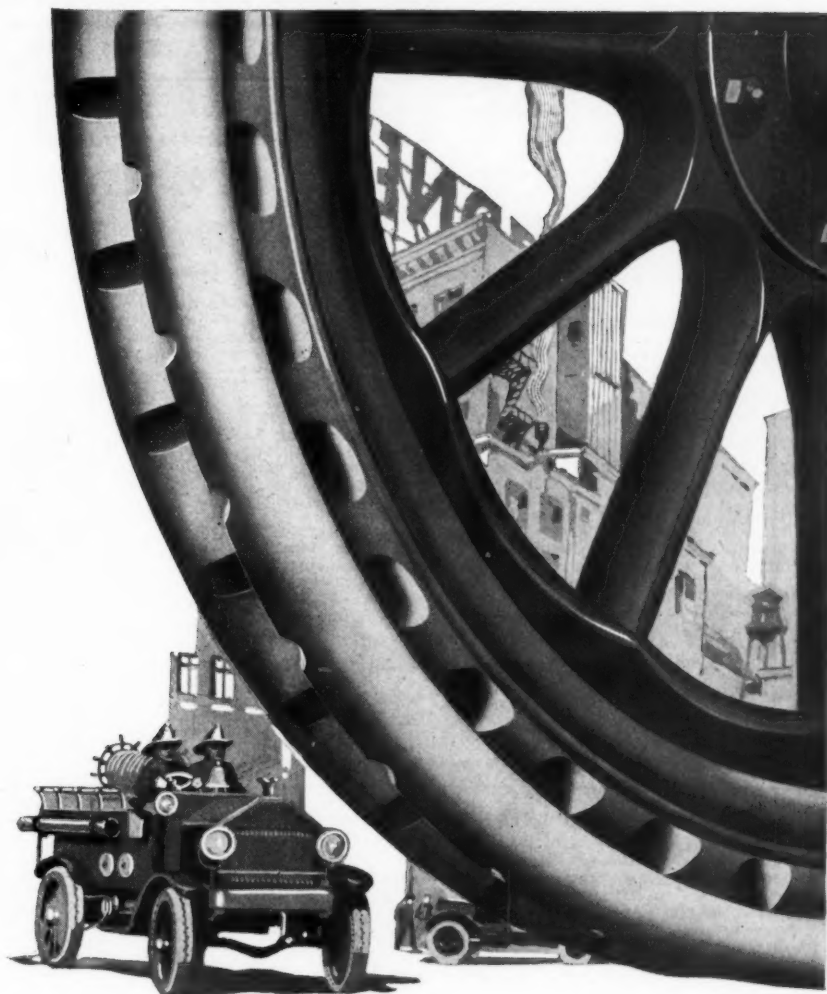
Syracuse, N. Y.—Board of Contract & Supply, Mar. 28, made an agreement by which, on payment of \$1,700, three automobiles were obtained in exchange for two old cars for Department of Public Works. Contract for supplying the city buildings with charcoal and wood was awarded James Carrier. Prices are \$12 a cord for hard wood, \$10 a cord for slab wood and 15 cts. a bushel for charcoal.

Coshocton, O.—At meeting of board of health Mar. 22 called for purpose of opening bids and awarding contract for disposition of city garbage, the contract was awarded Beal Adams, bid being for \$1,524.00 for taking care of entire city's garbage for the next year. The names of bidders and amount of bids were as follows: W. J. Clark, west of the Pennsylvania tracks, \$929; J. E. Corder, entire city, \$2,850; Benjamin Carnes, west of Pennsylvania tracks, \$835; Robert Nelson and William Turner, entire city, \$2,100; L. H. Young, entire city, \$2,400; L. G. Marple, west of Pennsylvania tracks, \$774; L. G. Marple, east of Pennsylvania tracks, \$1,000; Jay Abbott & Son, entire city, \$2,000; Kemmel Smith, west of Pennsylvania tracks, \$1,250; Frank S. West, west of Pennsylvania tracks, \$549; Frank S. West, east of Pennsylvania tracks, \$1,194; Frank West, entire city, \$1,725; Beal Adams, entire city, \$1,524.

Allentown, Pa.—Resolutions adopted awarding contract for cleaning of paved streets for term of two years ending April 1, 1918, to George H. Hardner, contract to be based "for cleaning by hand sweeping" and "for cleaning by machine flushing or washing" at unit rate or price for cleaning 1,000 sq. yds. once, and in accordance with terms of contract.

Norfolk, Va.—Board of Control awarded to Austin F. Smith contract for building stable for Norfolk Light Artillery Blues, for which, together with site, the council appropriated \$10,000. Mr. Smith's bid, which was lowest of several made, was \$7,325.

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AKRON, OHIO

TOO LATE FOR CLASSIFICATION

BIDS ASKED FOR

STATE	CITY	REC'D UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
STREETS AND ROADS				
N. J.	Irvington	3 p.m., Apr. 12	Furnishing crushed stone, screenings and road oil	I. J. Casey, Jr., Town Engr.
N. J.	South Orange	7.30 p.m., Apr. 17	1,150 ft. concrete curb and gutter, 1,780 ft. concrete curb and 590 sq. yds. Belgian block gutters	I. T. Redfern, Village Engr.
N. D.	Mandan	8 p.m., Apr. 20	Paving and curbing 29 blocks (see proposal ads)	W. H. Seitz, City Aud.
N. J.	Atlantic City	Apr. 20	Sidewalk repairs for 1916	City Engineer.
SEWERAGE				
Mass.	Boston	Noon, Apr. 13	25 tons c. i. manhole frames and covers	Boston Transit Company.
N. J.	South Orange	7 p.m., Apr. 17	6,170 ft. 8-in. sewer and 2,000 yds. excavation	I. T. Redfern, Village Engr.
O.	Middletown	Noon, Apr. 19	8 and 15-in. tile sewers	Clerk, City Commission.
Utah	Ogden	10 a.m., Apr. 24	Sewers in several streets	Walter Richey, City Recorder.
WATER SUPPLY				
Mass.	Boston	Noon, Apr. 10	115 tons 6-in. flexible joint c. i. pipe	D. F. Doherty, Supt. of Sup.
Fla.	Pensacola	Noon, Apr. 10	Constructing 8,000 ft. 6-in c. i. water main with hydrants, etc.	C. W. Eggart, City Clerk.
N. J.	Bayonne	4 p.m., Apr. 11	Labor and material for water main extensions	W. P. Lee, City Clerk.
Mass.	Boston	Noon, Apr. 11	800 post hydrant boxes, 800 gate boxes and 1,000 meter boxes (all concrete)	D. F. Doherty, Supt. of Sup.
N. Y.	Cobleskill	1 p.m., Apr. 17	Extending 8-in. water main 2,270 feet	J. L. Fuller, Chmn. Bd. of Water Comrs.
O.	Middletown	Noon, Apr. 19	Laying 6-in. c. i. water pipe	Clerk, City Commission.
O.	Middletown	Noon, May 1	Furnishing 2 electrically driven centrifugal pumps, 2,100 gals. per minute, and one steam pump, 3,000 gals. per day	Clerk, City Commission.
MISCELLANEOUS				
Cal.	Los Angeles	10 a.m., Apr. 10	12-ton motor roller	H. B. Ferris, Sec. Bd. of Pub. Works.
Mass.	Boston	Noon, Apr. 11	Fire escapes on the Hyde school	Schoolhouse Commissioners.
D. C.	Washington	Apr. 18	4,000 bbls. Portland cement at Leavenworth, Kansas	Supt. of Prisons.
W. Va.	Wheeling	Apr. 24	Valve jacks and gate operating machinery	U. S. Engineer Office.
N. Y.	New York	May 4	Dredging near Staten Island	U. S. Engineer Office.
D. C.	Washington	May 15	Constructing postoffice at Newport, R. I.	Supervising Architect.

STREETS AND ROADS

Los Angeles, Cal.—Ordinance has been approved for improvement of portions of Franklin Ave. by grading, paving and constructing sidewalks.

Sacramento, Cal.—Resolutions have been adopted by council ordering improvement of part of 23d St. by curbing, sewerage, construction of sidewalks and paving with asphalt.

Sacramento, Cal.—Council will order improvement of part of U St. by grading and paving.

Waterbury, Conn.—Street department is planning big improvement on South Main St. between Exchange Place and Washington St., which will be made this summer. Supt. Kennedy has obtained authorization of board of public works to "turn" all Belgian block paving on street between points named. The property owners will be notified that they must renew all water, gas, sewer and electric connections before June 1, at which time street department expects to begin work of improving the street.

Quincy, Ill.—Council will order macadamizing to be done on several streets.

Muncie, Ind.—Delaware County National Bank of this city was successful bidder for six of eight road bond issues sold yesterday by county treasurer. Merchants National Bank of this city was highest bidder for the other two issues. Issues purchased by the Delaware Bank are as follows: O. E. Boyd road, Washington township, bond issue \$7,400, bid \$157.52; Sherman Broyles road, Washington township, bond issue \$4,000, bid \$85.25; William Ritchie road, Harrison township, bond issue \$86,000, bid \$182.10; S. O. Thomas road, Harrison township, \$7,400 bond issue, bid \$157.52; F. M. Luce road, Liberty township, \$4,400 bond issue, \$93 bid; Andrew Woodring, Harrison township, \$6,400 bond issue, \$135.50 bid. The issues purchased by the Merchants Bank are as follows: William Bailey road, Liberty township, \$10,400 bond issue, \$221.95 bid; Charles Kern road, Monroe township, bond issue \$18,850, bid \$402.95.

South Bend, Ind.—Eddy St. and Mishawaka Ave. will be paved from Jefferson Blvd. to 19th St. Resolution was confirmed by board of public works at its session Mar. 28.

Joplin, Mo.—Barton county people are planning to build their section of Jefferson highway by forming special assessment road districts, under new state law which recently was declared con-

stitutional in test case. As planned this district will begin at north line of Jasper county at point north of city of Jasper and extend north for 9 miles. It will be 2 miles wide. They have already secured signatures for 3,900 acres, enough, they believe, to assure project a successful start. This will carry road half way across Barton county. Since above was accomplished, this committee has been working in vicinity of Irwin for forming a similar district for building proposed road in north part of Barton county.

Asbury Park, N. J.—Question of constructing proposed Ocean Blvd. link over foot of Deal Lake, at Asbury Park, will be taken up at April meeting of board of freeholders.

Asbury Park, N. J.—By a vote of 3 to 2 city commissioners Mar. 31 decided to ask for bids for relaying of the wood block pavement in Kingsley St. Then commissioners called up final decision on question of widening Main St. by asking City Counsel Carlton to prepare an ordinance to that end.

Atlantic City, N. J.—At conference between City Engineer John Hackney, Director of Streets J. B. Thompson, and several of the commissioners, Mar. 28, it was decided to pave about four or five miles of streets with hard surface pavements.

Atlantic City, N. J.—See "Water Supply."

Bayonne, N. J.—Ordinance has been introduced for repavement of Humphreys Ave., between Fifth and Seventh St.

Bayonne, N. J.—Seven bids have already been received by City Clerk William P. Lee for many streets which are about to be improved. Companies who submitted their bids are Sicilian Co., Uvalde Asphalt Co., Continental Co., Public Works Co., Construction Co., Post & Lakes Construction Co., Warner-Quinlan Co., Standard Bitulithic Co., and Cleveland Trinidad Co. A number of other bids are expected between now and April 11, when bidding will be closed.

Bayonne, N. J.—Petition has been received by council asking for improvement of Trask Ave. by curbing and paving.

Camden, N. J.—Work of laying 75,000 sq. yds. of asphalt was started April 3 by street commissioner. Thirty-nine thoroughfares will be paved. Patching work will also be done on principal streets. Street commissioner intends to double amount of work this spring and summer as compared with last year,

when 35,000 sq. yds. of asphalt was done.

Elizabeth, N. J.—As a result of favorable report of street commissioner, resolution was passed asking city council for appropriation of \$297,469.35 for paving of various streets to be improved under fifty-fifty plan, as outlined in original plan, omitting only Spring St. This request will come before council April 5, and will probably be granted. Ordinances providing for paving will then be introduced by board of works and every effort will be made to expedite work.

Elizabeth, N. J.—Five ordinances were passed March 30th on first and second reading for streets to be paved under city charter for which money was appropriated by city council at last meeting, namely, Bridge St. from Elizabeth River to Pearl St.; Caldwell Pl. from Broad to South Union Sts.; Meadow St. from Magnolia Ave. to intersection of Jackson Ave. and Jackson Ave. from Meadow to Louisa St., and Front St. from Livingston to East Jersey Sts., and for one street to be paved on petition, Clover St.

Morristown, N. J.—County Engineer Frederick S. Smith estimates that it will cost thousands of dollars to make necessary repairs on roads this season.

Perth Amboy, N. J.—Superintendent of Public Works S. Frank Mason has been instructed by council to have Potter Hill road repaired.

Plainfield, N. J.—Councilman Thomas F. Hylan, chairman of street committee, has said that financial requirements for putting streets in condition this year will approximate \$90,000.

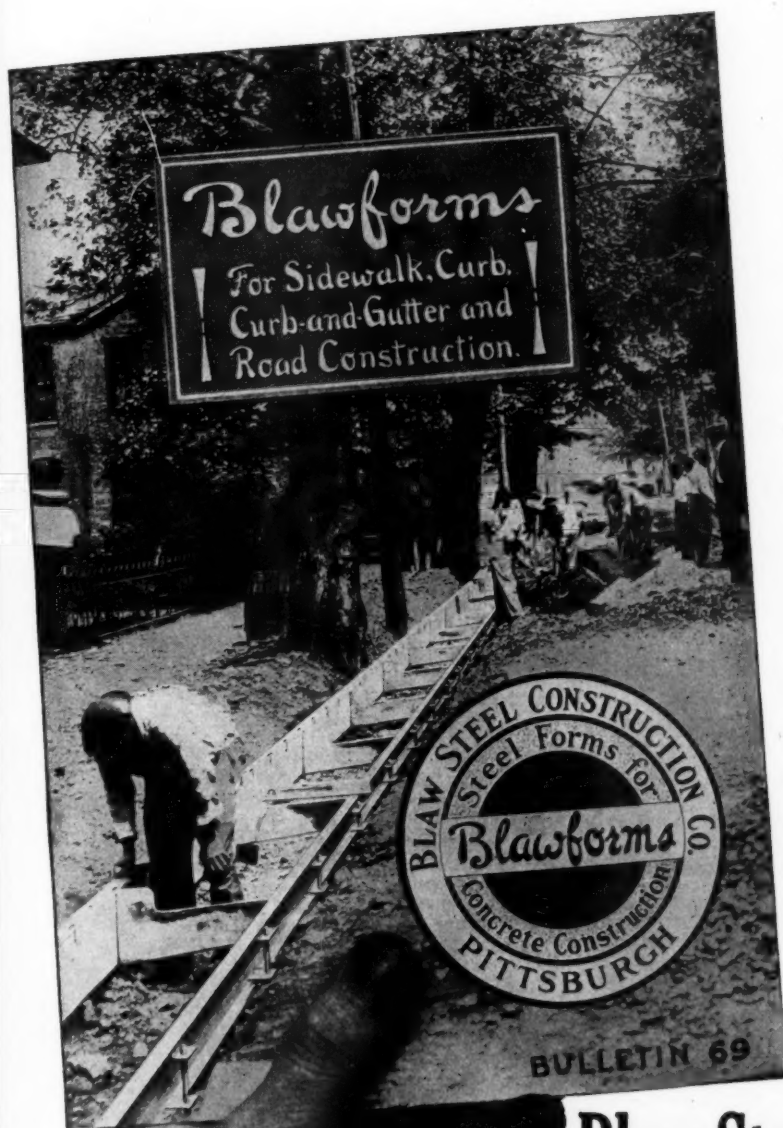
Glenville, N. Y.—At town board meeting to be held April 6, board will act on resolution presented at last meeting urging improvement of Charlton-Burnt Hills road next year as county highway, and Supervisor W. R. Williams will appoint highway committee, chief among duties of which will be adoption of a regular schedule for improvement of all important roads of town during next few years.

Lisbon, O.—County commissioners have passed supplemental resolutions to the original resolutions adopted more than two weeks ago providing for paving or macadamizing of many miles of public highway in the county, to a width of 14 ft. The supplemental resolutions provide for additional width to the roads, not in the paving but in grading and finishing of dirt roads, width stated in

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PROPOSALS

OFFICE OF THE STATE COMMISSION OF HIGHWAYS.

Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock P. M., on Thursday, the 20th day of April, 1916, for the improvement of the highways in the following counties:

ONONDAGA (two highways—2.40, 5.12);
SARATOGA (approx. 5.74);

ULSTER (approx. 0.49); together with a concrete bridge.

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "GENERAL INFORMATION FOR BIDDERS" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.

I. J. MORRIS,
Secretary.

FENCES

SEALED BIDS will be received by the Board of Water Supply, at its offices, twenty-second floor, Municipal Building, Park Row, Centre and Chambers streets, New York City, until 11 A. M., on Tuesday, April 25, 1916, for Contract 173, for furnishing and erecting about 5 miles of wire fence, short stretches of concrete and wooden guard-rail and some galvanized-steel pipe railing in the vicinity of the Kensico reservoir. The work is located in the Towns of Mt. Pleasant and North Castle, Westchester County, New York.

At the above place and time the bids will be publicly opened and read. Pamphlets containing information for bidders and contract drawings can be obtained at the above address, at the office of the Secretary, by depositing the sum of ten dollars (\$10) in cash or its equivalent for each pamphlet. For further particulars apply to the office of the Principal Assistant Engineer at the above address.

CHARLES STRAUSS, President,
CHARLES N. CHADWICK,
JOHN F. GALVIN,

Commissioners of the Board of Water Supply.

GEORGE FEATHERSTONE, Secretary.

FOR SALE

One "OO" Austin Trenching Machine with ten-foot extension, nearly new. Address J. E. Poinexter, Receiver, Fayetteville, Tennessee.

FOR SALE CHEAP

Wrought Pipe, second hand, all sizes, recut and rethreaded suitable for all classes of work. Prices quoted on application.

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FOR SALE Complete Filtration Plant

4 filter tanks with sand
Capacity 2,000,000 gals. per day
Rails—Cars and Locomotives—
Equipment

Zelnicker in St Louis

FOR SALE AT BARGAIN

One No. 0 Austin Trench Machine. Boom to dig 15 ft.; 18 and 24 inch buckets. Gasoline power. Used only 3 months. Inquire, Mathias Stipp, 435 Moir Court, Scranton, Pa.

FOR SALE Voting Machines

Five Abbott Voting Machines in perfect condition. City cannot use owing to change having been made in voting precincts. Will sell or trade for other city equipment. These machines are good and simple to operate, insuring accurate count of ballots the moment the polls are closed, doing away with half the usual number of Clerks and Inspectors at elections.

Write City Clerk, care of Municipal Journal.

FOR SALE

One Gas Macadam Roller. Little used. Low price. Write Henderson Contracting Company, c/o The Municipal Journal.

WANTED

One 10-ton Macadam Roller at a bargain. Send lowest cash price and description to—Lannen & Davis, c/o The Municipal Journal.

NOTICE TO STOCKHOLDERS

The annual meeting of the stockholders of MUNICIPAL JOURNAL and ENGINEER (Incorporated) will be held at the company's office, 50 Union Square, New York City, Monday, April 17, 1916, at 10 o'clock a. m.

14-15 A. PRESCOTT FOLWELL, Secretary.

Mandan, N. D.

Bids will be received by the City Auditor until 8 P. M., April 20th, for paving, curbing and accessory work for 29 blocks.

Wood Block, Sheet Asphalt, Bitulithic, Bituminous Concrete or Tarvia.

W. H. SEITZ,
City Auditor.

the resolution including both brick and graded dirt road. Additional width is provided for following roads: Salem-Goshen road in Perry township, 7,432 ft., to be 24 ft. wide; East Palestine-New Waterford road in Unity township, 13,674 ft., to be 30 ft. wide; Salem-Canfield road in Perry township, 6,977 ft., to be 30 ft. wide; Thomas public road in Knox township, near Homeworth, 10,650 ft., the graded part of the west side 30 ft. wide and the graded part of the east half 24

ft. wide; East Palestine-Negley road in Unity township, 6,014 ft., 24 ft. wide; Rogers-East Fairfield road in Middleton township, 2,764 ft., 24 ft. wide; East Liverpool-Warren road in Middleton township, 2,764 ft., 24 ft. wide; East Liverpool-Warren road in Middleton township, 24 ft. wide; East Liverpool-East Palestine road in Middleton township, 24 ft. wide; Salem-Lisbon road in Center and Salem townships, 24 ft. wide; Lincoln Highway in Center and West townships, 30 ft. wide; Wellsville-Lisbon road in Madison township, 24 ft.; Lisbon-Salineville road in Wayne township, 24 ft.; Wellsville-Lisbon road in Yellow Creek township, 24 ft.

Lisbon, O.—County commissioners in session Mar. 31 rounded out plans for improvement of other public roads in county, and instructed Road Superintendent Armstrong to prepare plans and specifications for improvement of the same, and submit them as soon as possible. Wellsville-Oak Grove-Calcutta road, in Liverpool township, is among the latest ordered improved. Road improvement will begin at the intersection of Main Market road in township with the road to be improved and will extend in northeasterly direction, a distance of 3,250 ft. Road will be paved with paving blocks, on concrete base, to a width of 14 ft. East Liverpool-Cannons Mill Lisbon road, in St. Clair township, will be graded and drained distance of 15,263 ft., beginning at point where road intercepts with the Wellsville-Camp Ground road, and running in northwesterly direction. Road known as the Park Way road in Liverpool and St. Clair townships, will also be graded and drained for distance of 10,493 ft., beginning at point where the road intercepts with Park Blvd. at north end of the concrete road improvement now being constructed by trustees of Liverpool township. Road will be made 20 ft. wide. Kensington-Carrollton public road in Hanover township will be graded, drained and macadamized, with water bound slag, for distance of 2,367 ft. Improvement will be 14 ft. wide.

Salem, O.—City will issue bonds in sum of \$15,000 for resurfacing, repairing and improving streets. Resolution has been approved for improvement of Jennings Ave. by grading, curbing and paving roadway with vitrified brick block.

DIRECT Proposal Advertising Pays

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